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# ***JPRS Report***

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# **Science & Technology**

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***China***

## SCIENCE &amp; TECHNOLOGY

## CHINA

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#### PHYSICAL SCIENCES

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## SIMULATION OF EFFECT OF ANTI-RADAR STEALTH PRINCIPLE

40090082 Beijing XITONG GONGCHENG LILUN YU SHIJIAN [SYSTEMS ENGINEERING--THEORY AND PRACTICE] in Chinese Vol 7 No 1, 1987 pp 43-48

[Article by Zhao Borao [6392 0130 1031], Xing Shuchen [6717 2579 6591] and Li Chunyi [2621 2504 3768]]

[Abstract] The paper presents simulation methods and results of the anti-radar stealth principle, proving that anti-radar stealth aircraft can drastically reduce the combat efficiency of an air defense radar system. In particular, with anti-radar stealth aircraft are coordinated with jamming as a self-defense soft weapon, the discovery probability, response time and hit rate of the air defense radar system are much lower, with extensive reduction in jamming power and maximum exposure distance of self-defense and long-range support. The paper describes an assumed combat situation and construction of a calculation model for the aircraft survival rate, as well as simulation results and analysis.

Four figures show an enemy bomber attacking an airfield, as well as the effects of the radar effective reflecting surface on discovery probability, guidance radius, aircraft survival and exposure distance (for long-range support and jamming). Four tables list data involving the cases shown in the figures. The paper was received for publication on 15 May 1986.

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## MODELS OF WEAPONRY MANAGEMENT SYSTEM DESCRIBED

40090082 Beijing XITONG GONGCHENG LILUN YU SHIJIAN [SYSTEMS ENGINEERING--THEORY AND PRACTICE] in Chinese Vol 7 No 1, 1987 pp 49-56

[Article by Wang Tinglan [3769 5121 5695]]

[Abstract] In order to achieve management modernization of weaponry during its service stage, the paper analyzes an equipment management system from the standpoint of systems engineering and modern management theories, thereby deriving a mathematical description model and a practical management model (based on the author's "Scheme of Modern Equipment Management") for reference in equipment management for military, industrial and civilian application. Just as in the management of industrial equipment, weaponry management can be divided into technical and economic management, and includes ranking-stage management during the design and manufacture, and final-stage management during use.

Three figures show analyses of elements, essentials and environment, a work and material flowchart of the system and a modular-diagram model for modern weaponry management. One table shows weight estimates of equipment components. The paper was received for publication on 18 Apr 1986.

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FEATURES OF POLARIZED OUTPUT OF ANISOTROPIC TWO-MODE LASER

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7  
No 10, Oct 87 pp 865-868

[English abstract of article by Li Shifang [2621 0013 5364], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] It is reported that multistability behavior can be observed in a He-Ne laser into which an anisotropic polarized loss is introduced. This phenomenon is explained as a competition between the saturation-induced polarization preference and the anisotropism of the laser, as well as the effect of fluctuation on the modes with equal resonance frequency and different polarization directions. (Received 16 Aug 86; revised 12 Jan 87.)

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EFFECT OF ADDITIVE WITH LOW IONIZATION POTENTIAL ON OUTPUT ENERGY OF XeCl  
EXCIMER LASER

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10,  
Oct 87 pp 875-878

[English abstract of article by Li Zhaolin [2621 2507 5259], et al., of Anhui  
Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] An additive with low ionization potential at extremely low concentra-  
tion can be used to improve the level of preionization of the XeCl excimer  
laser. The  $C_6H_5Cl$  and  $CCl_4$  additives have been used in our experiment, with  
the enhancement of laser output energy of up to 16 percent being observed.  
This is especially important in the development of large cross-section rare  
gas halide discharge. (Received 20 Oct 86; revised 2 Mar 87.)

9717

NEW METHOD FOR ANALYZING THERMO-STABLE TELESCOPIC RESONATOR

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 879-885

[English abstract of article by Lu Zukang [7120 4371 1660], et al., of the Department of Optics Engineering, Zhejiang University, Hangzhou]

[Text] A new simplified method--the compound lens method--for analyzing the thermo-stable telescopic resonator is reported. Using this method, the authors successfully obtained the stable output with a large volume of TEM<sub>00</sub> mode for a high repetition rate Nd:YAG laser. The output energy of the resonator at 1.06  $\mu\text{m}$  is 250 mJ per pulse over the range of 1-10 pps, and the output energy fluctuation is less than  $\pm 2$  percent. (Received 1 Dec 86; revised 16 Feb 87.)

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FULL QUANTUM THEORY OF OPTICALLY PUMPED TWO-PHOTON LASER

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 886-891

[English abstract of article by Sun Songgeng [1327 2646 1649] of the Department of Physics and Chemistry, Nanjing Communication Engineering Institute]

[Text] In this paper, the model consisting of homogeneous-broadened three atomic levels is proposed, when both the pump classical field and laser field exist. The author discusses the gain, frequency pulling and threshold conditions of the weak pumping. The effects of coherent pumping on the laser linewidth are also discussed. The results are compared with those derived for non-coherent pumping and no-pumping. (Received 19 Aug 86; revised 24 Oct 86.)

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LASER-INDUCED MULTIPHOTON FLUORESCENCE OF HEMOGLOBIN

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 897-902

[English abstract of article by Zhang Jingru [1728 2533 1172], et al., of the Laser Spectroscopy Laboratory, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei; Jiang Shouping [3068 1108 1627], et al., of Shanghai Institute of Biochemistry, Chinese Academy of Sciences]

[Text] Hemoglobin and other samples were irradiated by the 1064 nm light of a nanosecond pulse Nd:YAG laser. At room temperature, the authors first observed two red fluorescent bands resulting from absorbing two 1064 nm photons in hemoglobin (Hb), and measured the fluorescence emission spectra at the red region for Hb and hemotoporphyrin derivative (HpD). Both Hb and HpD have two fluorescence emission maxima. A red shift in wavelength and a mirror image in the intensity of fluorescence emissions by two-photon excitation relative to that by one-photon (532 nm) excitation were observed. The experimental analysis shows that the fluorescence of Hb originates from the porphyrin ring of the heme group, just as that of HpD originated from the porphyrin ring. In addition, the authors also observed the fluorescence emission at UV 392 nm for Hb, which may come from the tryptophans in Hb. (Received 8 Dec 86.)

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## NEW MODEL OF ASSOCIATIVE MEMORY IN OPTICAL COMPUTING

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 911-916

[English abstract of article by Yang Shining [2799 0013 1337] of Guangzhou Institute of Electric Technology, Chinese Academy of Sciences]

[Text] A new memory model of associative memory, called the reflexive associative memory in optical computing, is presented in this paper. In this model the vectors are stored in a memory matrix in the form of vector pairs. Not only can a full vector prestored in associative memory be recalled from partial information of the vector, but the other vector of the prestored vector pair can also be recalled. Optical implementation of the reflexive associative memory is also presented in this paper. (received 22 Sep 86; revised 1 Dec 86.)

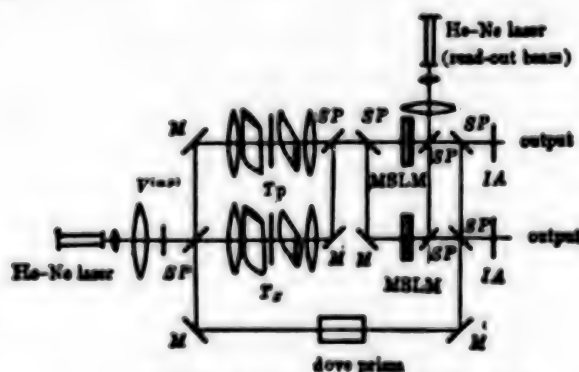


Diagram for optical implementation of the reflexive associative memory

$T_p$ —positive mask of memory matrix;  $T_n$ —negative mask of memory matrix; MSLM—micro-channel space light modulator; IA—intensity attenuator; M—mirror; SP—beam splitter.

**CALCULATION OF RADIATION LOSS IN SINGLE MODE FIBERS BY EQUIVALENT CURRENT METHOD**

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 923-928

[English abstract of article by Wang Zihua [3769 1311 5478] of Shanghai University of Science and Technology]

[Text] Taking a non-ideal waveguide as an ideal waveguide in the presence of polarization currents giving rise to electric and magnetic fields, the author directly solves the problems of mode coupling and radiation loss of an optical waveguide. Using this method, the radiation loss of single mode fibers caused by periodic and random non-uniformities of the core index is calculated. It is an alternative method of the coupled mode theory, but is mathematically simpler and physically more intuitive than the coupled mode theory. Finally, taking bending and microbending loss for single mode fibers as an example, the author shows that this method can also be applied to problems which can be solved by the generalized coupled mode theory. (Received 25 Sep 86; revised 17 Dec 86.)

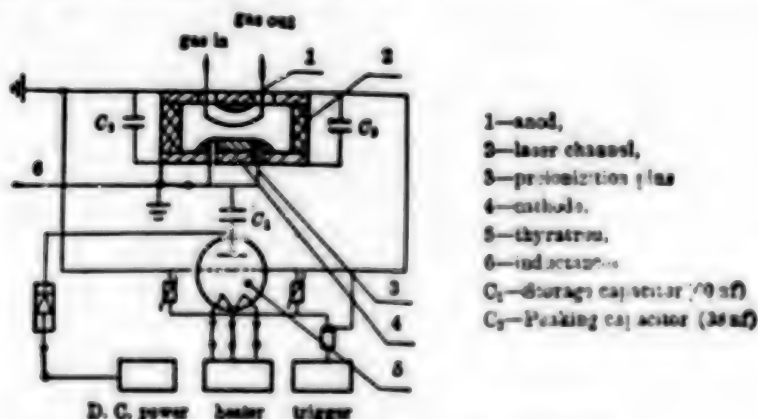
9717

## HIGH REPETITION RATE XeCl EXCIMER LASER

40090035 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 10, Oct 87 pp 957-960

[English abstract of article by Nan Yingzi [0589 5391 1311], et al., of Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The configuration and performances of a high repetition rate XeCl excimer laser are reported. A ceramic-metal grounded grid thyatron used as a pulse switch, transverse flow system and a fast transverse discharge structure of UV preionization are adopted in the laser system. The maximum output pulse energy is 200 mJ and maximum average power is 18 W at a repetition rate of 107 Hz. (Received 27 Oct 86; revised 23 Feb 87.)



Schematic Diagram of Circuit

SCINTILLATION NEUTRON DETECTOR FOR LASER FUSION RESEARCH

40090024 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 3, Sep 87 pp 180-182

[English abstract of article by Yang Feng [2799 6912], et al., of the Institute of Physics, Chinese Academy of Sciences, Beijing]

[Text] A fast neutron detector for laser nuclear fusion experiments is described. It consists of a large plastic scintillator and a fast photomultiplier 58AVP. The total yield and time behavior of neutrons from a plasma focus set-up has been registered on a fast oscilloscope. The detection efficiency was about  $10^{-3}$ .

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MICRO-DEFECTS IN SILICON CRYSTAL BY LASER-FLUORESCENCE

40090040 Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY] in Chinese  
Vol 26 No 3, Sep 87 p 357

[English abstract of article by Zong Xiangfu [1350 4328 4395], et al., of  
the Institute of Materials Science]

[Text] Using room-temperature laser-fluorescence microscopic technology, the micro-defects of silicon were observed. The morphology obtained by the above technology coincides with the figure obtained by preferential etching. These results prove that laser-fluorescence microscopic technology will be a non-contactive, non-destructive and very sensitive method for defect monitoring in silicon.

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PULSED LASER CHARACTERISTICS OF NEODYMIUM ALUMINUM BORATE CRYSTALS

40090031 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 9, 20 Sep 87 pp 524-528

[English abstract of article by Huang Yichuan [7806 1150 1557], et al., of  
Fujian Institute of Material Structure, Chinese Academy of Sciences, Fuzhou]

[Text] This paper presents the pulsed laser characteristics of laser neodymium aluminum borate [ $\text{NdAl}_2(\text{BO}_3)_3$ ] (NAB) crystals grown in the authors' institute. The maximum laser output of a NAB rod with dimensions of  $\phi 3.2 \text{ mm} \times 23.7 \text{ mm}$  was 422 mJ per pulse when it was pumped with a single xenon flashlamp. The laser threshold of a NAB crystal rod with dimensions of  $\phi 1.8 \text{ mm} \times 2.4 \text{ mm} \times 8.4 \text{ mm}$  was determined to be 67 mJ. By using BDN dye for switching, the laser pulse width of a NAB rod with dimensions of  $\phi 1.8 \text{ mm} \times 8.4 \text{ mm}$  was 8 ns. The output laser beam was linearly polarized with a beam divergence angle of about 2 mrad and wavelength of  $\lambda = 1.063 \mu\text{m}$ . (Received 11 Jul 86.)

9717

MEASUREMENT OF 3-D DISPLACEMENT VECTOR USING PHASE-COMPARISON ON FOURIER TRANSFORM PLANE

40090031 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 9, 20 Sep 87 pp 540-543

[English abstract of article by Chen Mingyi [7115 2494 0308], et al., of the Department of Fine Mechanical Engineering, Shanghai University of Science and Technology]

[Text] An investigation of the phase change on the Fourier transform plane caused by a moving object shows that it is possible to measure a three-dimensional displacement vector using a comparison of the phase-change recorded on a double exposure hologram. Based on it, a novel approach for measuring a three-dimensional displacement vector is described here. Theoretical analysis shows that the exposure hologram for three-dimensional displacement measurement have been effectively avoided. Experimental results coincide well with the theoretical analysis. A quantitative calculation method is also presented. (Received 4 Aug 86.)

9717

OUTPUT POWER OF DYE LASER PUMPED BY Cu VAPOR LASER WITH DIFFERENT OSCILLATOR STRUCTURES

40090031 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 9, 20 Sep 87 pp 560-562

[English abstract of article by Liang Peihui [2733 1014 6540], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] By means of experimental and simple theory, the authors have investigated the output power of the tunable dye laser pumped by a Cu vapor laser with planar and concave mirrors used as the front mirror of the dye laser. The experimental results show that, for the same oscillator length, there is a higher output power for the concave mirror than for the planar one, which agrees with the authors' theory. (Received 6 May 86.)

9717

**STUDY OF RELATIONSHIP BETWEEN SPONTANEOUS RADIATION AND STIMULATED RADIATION  
IN CERENKOV FREE ELECTRON LASERS**

40090037 Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 10,  
Oct 87 pp 1336-1343

[English abstract of article by Zhang Yibo [1728 3015 3134] of the Microwave  
Electronics Research Institute, Chengdu Institute of Radio Engineering]

[Text] In this paper, based on a single-particle model, the relationship  
between spontaneous radiation and stimulated radiation in Cerenkov free  
electron lasers is obtained. The results show that in Cerenkov free electron  
lasers there is a relationship similar to the Madey Theorem in wiggler free  
electron lasers. The gain calculation of oblique angle stimulated Cerenkov  
radiation by using this relationship is given.

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SUGGESTION FOR NEUTRON GENERATION WITH POWERFUL LASERS

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 641-645

[English abstract of article by Wang Ganchang [3769 3227 2490] of the Chinese Academy of Nuclear Science, Beijing]

[Text] A concrete suggestion for producing neutrons using laser light is put forward. Also described are the reasons for selecting LiD as a preferential target and the dependence of neutron yield  $N$  on the incident light energy  $E$  and the focus range. In addition, the preparation of LiD targets and an experimental demonstration of the neutron and X-ray together with some issues involving quantitative measurement are discussed. To make the facility compact, the author proposes that chemicals be used instead of capacitors. (Received 10 Jun 87.)

9717



TWO-DIMENSIONAL THEORETICAL MODEL FOR DIFFUSIONAL CW OXYGEN-IODINE CHEMICAL LASERS

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 646-649

[English abstract of article by Feng Hao [7458 3185], et al., of Dalian  
Institute of Chemical Physics, Chinese Academy of Sciences]

[Text] A two-dimensional theoretical model for predicting the diffusional CW oxygen-iodine laser performances is presented. The parallel mixing at constant later pressure between a pair of primary and secondary streams is assumed. A set of parabolic partial differential equations is solved using the finite-difference techniques. The change in specific power with flow direction and the effect of the concentration of  $O_2(^1\Delta)$  on specific power are studied.  
(Received 14 Jul 86.)

9717

**LARGE VOLUME UV PREIONIZED TEA CO<sub>2</sub> LASER CONTAINING Ar**

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 650-653

[English abstract of article by Yu Shusheng [0060 3412 3932], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] In a large volume UV preionized TEA CO<sub>2</sub> laser, partial replacement of He with industrial-grade Ar is possible. The effects of Ar content on the discharge stability and the output pulse energy are studied. When CO<sub>2</sub>-N<sub>2</sub>-He-Ar is doped with tripropylamine, the discharge stability can be improved.  
(Received 2 Aug 86.)

9717

SINGLE-MODE PULSED DYE LASER PUMPED BY COPPER VAPOR LASER

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 654-657, 653

[English abstract of article by Zhao Meicun [6392 2734 2625], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The design of a pulsed single-mode dye laser pumped by a copper vapor laser is presented. The experimental results using Rh6G, RhB and Kiton Red S are given. The dye laser produces up to 200 mW single-mode average power at an efficiency of over 4.5 percent. The linewidth of the single-mode laser is 100 MHz, and its wavelength range is 563-642 nm. (Received 4 Sep 86.)

9717

INVESTIGATION OF REGULARITY OF FREQUENCY DOUBLING EFFECT IN BENZENE DERIVATIVE MOLECULAR CRYSTALS

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 662-666

[English abstract of article by Li Songxian [2621 1345 6343], et al., of the Department of Chemistry, Fuzhou University; Wu Bochang [0702 2672 2490] of Fujian Institute of Matter Structures, Fuzhou]

[Text] The dipole moments of 18 benzene derivative molecules were calculated theoretically and the frequency doubling properties of their crystals were predicted. These molecular crystals have been synthesized and their frequency doubling effects and molecular dipole moments have also been measured. The theoretically predicted frequency doubling properties were in fair agreement with the measured values. This provides new evidence that there is a correlation between the frequency doubling effects and the molecular dipole moments, a theory put forward by the authors some time ago. Four benzene derivatives that may become promising frequency doubling materials have been selected. Among them, the intensities of second harmonic efficiency of 3-MNA and 3-NBA are 7 and 2, respectively, with that of ADP taken as unity. (Received 25 Sep 86.)

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LASER POWER SUPPLY WITH NEWLY-DESIGNED THYRISTOR THREE-PHASE RECTIFIER

40090032 Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese  
Vol 14 No 11, 20 Nov 87 pp 689-692

[English abstract of article by Wang Shikang [3769 0099 1660], et al., of  
Tianjin University]

[Text] A newly-designed thyristor full-wave rectifier is introduced here. Differing from the traditional synchronizing and triggering mode, the rectifier adopts the opto-electric coupler as isolator and the outer-EPRM set as pulse allotter. Although both the analog and digital modes are involved in the processing of signal transmission, the main process, including series-phase-shifting and parallel triggering, is formed by the digital circuit. Therefore, apart from the advantages of simplicity and reliability, the outstanding advantage is the high anti-disturbance ability. It can be the first choice as a laser power supply. (Received 10 Sep 86.)

9717

RESEARCH ON HIGH PRECISION LOGARITHMIC AMPLIFYING CIRCUIT

40090027 Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese No 5, No. 97 pp 404-412

[English abstract of article by Kong Junbao [1313 0193 1405] of Nanjing Institute of Posts and Communications]

[Text] A high precision logarithmic amplifier with wide passband is achieved by using the charge and discharge of RC and the method of pulse-width modulation. It can be used in astronomy, astronavigation, accurate measurement, communications, etc. The theoretical analysis of the circuit is given. A practical circuit is constructed, and the experimental results show that the logarithmic function for the circuit reaches 99 percent of the theoretical value.

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STUDY OF Si(100) AND (111) SURFACES AND MOLECULAR BEAM EPITAXY OF Ni ON THEM BY RHEED

40090027 Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese No 5, Dec 87 pp 420-427

[English abstract of article by Gao Mingtai [7559 6900 0669] of the Institute of Electronics, Chinese Academy of Sciences]

[Text] Clean Si (100) and (111) surfaces produced by  $\text{Ar}^+$  ion bombardment and high temperature annealing techniques, and the epitaxial growth of nickel silicides on them at room temperature using the molecular beam method, are studied by reflection high energy electrodiffraction (RHEED). The experimental results show that Si(111)7x7 and its negative zone RHEED pattern, Si(100)2x1, Si(111) $\sqrt{19} \times \sqrt{19}$  Ni and Si(100)4x2 Ni structures are obtained. The lattice structures of nickel silicide produced during epitaxy with a low growing rate (0.16-0.5 Å per minute) is the same as that of silicon substrates.

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OBSERVATION AND STUDY OF DARK DEFECTS IN InGaAsP/InP DOUBLE-HETEROSTRUCTURE LEDS

40090027 Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese No 5, Dec 87 pp 435-440

[English abstract of article by Zhang Guicheng [1728 2710 2052], et al., of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences]

[Text] The dark defects in InGaAsP/InP DH LEDs are observed with an infrared line scanner. The dark structure appears before aging and exists mainly in the form of a dark spot defect. The effect of the variety and concentration of the doping for p-InP confining layers on the dark defects is studied. The results show that the percentage of devices with dark defects is much lower for Mg or In-Zn-doped devices than for Zn-doped devices. It is believed that Zn is one of the important origins of the formation of dark defects. The growth rate of dark defects is studied both at room temperature and at 70-85°C. The results show that after aging for 15,000 hours at room temperature there are no new dark defects. However, after another 2,000 hours at 70-85°C, some devices show newly-formed dark structures with very slow growth rates.

9717

RESEARCH ON MICROWAVE PLASMA SOURCE

40090027 Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese No 5, Dec 87 pp 458-464

[English abstract of article by Wu Jinfa {0702 6930 4099}, et al., of the Department of Radio and Electronics, Qinghua University]

[Text] Using the principle of electron cyclotron resonance, a microwave plasma with a high degree of ionization and activity is obtained under lower pressure of from  $10^{-3}$  to  $10^{-6}$  Pa. In this paper, the influences of the microwave input power and gas pressures on the parameters of plasma in nitrogen and argon are studied with the Langmuir probe, and mass spectrographic analysis is also made.

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## ADAPTIVE CONTROL OF SCIENTIFIC BALLOON-BORNE GONDOLA ATTITUDE

40090028 Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE]  
in Chinese Vol 7 No 4, Oct 87 pp 262-271

[English abstract of article by Yan Yan [7346 1484] of the Space Science and Technology Center, Chinese Academy of Sciences]

[Text] The uncertainty of parameters of the mathematical model for the control system of a balloon-borne gondola attitude is analyzed in this paper. The effects of this uncertainty on the system performance are also verified through digital simulations and experiments. In searching for the ideal control characteristics, a model reference adaptive control for the gondola attitude is developed based on Popov's hyperstability theory. This paper presents the discrete adaptive algorithm which gives time varying adaptive gain, and a large number of digital simulations are conducted accordingly. The results show the advantages of this new method over the traditional one in coping with problems such as parameter variations over a wide range, unknown parameters and nonlinearities. The new approach also proves to have higher adaptive speed and is easier to implement than other adaptive control methods.

Schematic diagram of the balloon-borne gondola

- a—扭性电机 (Twisting motor)
- b—降落伞 (Parachute)
- c—磁敏传感器 (Magnetic sensor)
- d—吊篮 (Gondola)
- e—反作用飞轮 (Reaction wheel)



ANALYSIS OF SPECTRAL REFLECTANCE CHARACTERISTICS OF TARGETS UNDER SATELLITES  
AND AUTOMATIC CLOUD RECOGNITION

40090028 Beijing KONGJIAN KEXUE XUEBAO [CHINESE JOURNAL OF SPACE SCIENCE]  
in Chinese Vol 7 No 4, Oct 87 pp 321-326

[English abstract of article by Wang Li [3769 7787], et al., of Institute  
No 207, Ministry of Astronautics]

[Text] A method for real-time automatic classification of targets and the automatic control of camera shutters are discussed. A physical model computing the radiance is presented, the influences of the atmosphere are considered and the spectral reflectance characteristics of five kinds of targets are analyzed. The radiance of 34 targets under 9 different atmospheric conditions are computed with the model. The best wavebands, and also classification functions and classification flow diagrams for five kinds of targets are determined. The problem involving distinguishing clouds from non-clouds is studied. Ten Landsat MSS pictures are measured with the TD504 densimeter, with the radiance distribution chart similar to the calculation results. A discussion is also presented regarding ways to realize the real-time automatic recognition of clouds on the satellite.

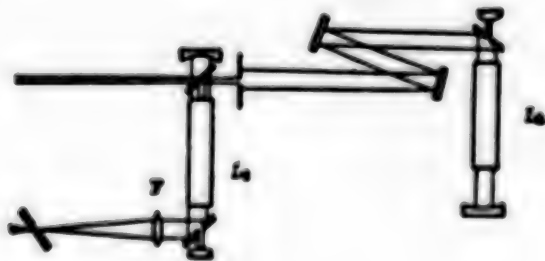
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## EXPERIMENTAL STUDIES OF INJECTION LOCKED COPPER VAPOR LASER

40090025 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 9, Sep 87 pp 783-788

[English abstract of article by Liang Peihui [2733 1014 6540], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper presents a study of the influences of timing, injected signal power and injected beam diameter on the output power and divergency of an injection locking system, which is composed of two similar telescopic unstable CVLs, with a  $45^\circ$  glass plate inside one laser as coupling optics. The results show that the injected signal strongly suppressed the competition of high order transverse modes (including ASE) in the cavity, leading to a simultaneous rise in the efficiency and improvement of the divergency. When the output power was about 5W, the injection locked system raised the power by 30-40 percent and reduced the divergency to half when compared with the independent unstable resonator. (Paper received 25 Nov 86; revised 17 Feb 87.)



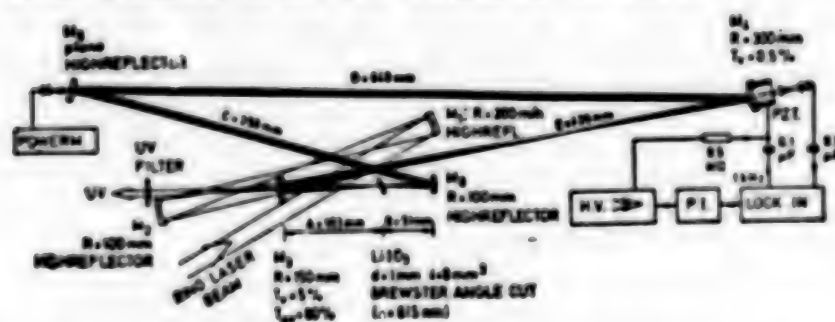
Schematic Diagram of Experimental Set-up

## EXTERNAL CAVITY AND ITS APPLICATIONS

40090025 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 9,  
Sep 87 pp 789-793

[English abstract of article by Wang Naiguang [3769 0035 0342] of the Laser Spectroscopy Laboratory, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper reports the enhanced mechanism of a dye laser in an external resonant cavity and its construction. The applications of an external resonant cavity in Doppler-free spectroscopic measurement and in frequency doubling of a single-mode CW dye laser are introduced. The author achieved a conversion efficiency of frequency doubling over 100 times the original level using the cavity. (Paper received 21 Aug 86; revised 20 Oct 86.)



### Experimental Set-up for Optical Frequency Doubling of a Single Mode Dye Laser in an External Ring Resonator

OPTICAL FIBER VELOCITY INTERFEROMETER

40090025 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 9, Sep 87 pp 806-811

[English abstract of article by Tan Shen [6223 3234], et al., of the Department of Applied Physics, National Defense University of Technology; Xie Xinjun [6200 2450 6511] of the Department of Physics, Xiangtan University]

[Text] In this paper the authors report a new type of velocity interferometer--an optical fiber velocity interferometer--which uses optical fiber as the delay arm. It can be used more conveniently and accurately to measure velocities in different ranges, varying in time, by choosing different lengths of optical fiber according to the range of velocity and required measurement accuracy. This system provides two signals with phase differences of  $90^\circ$ , therefore, giving higher resolving power and distinguishing acceleration or deceleration. (Paper received 5 Nov 86; revised 28 Nov 86.)

9717



AUTOMATIC DESIGN OF OPTICAL COATINGS WITH CALCULATED RATE OF FINISHED PRODUCTS  
AS END MERIT INDEX

40090025 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 9,  
Sep 87 pp 818-823

[English abstract of article by Zheng Yanfei [6774 3601 7378], et al., of the  
Department of Optical Engineering, Zhejiang University, Hangzhou]

[Text] A new automatic design method of optical thin film systems is presented in which the effect of the errors in monitoring optical multilayer coatings on the performance is considered. The merit function in the design involves not only the optical properties, but also the rate of finished products of the multilayer coatings by computer simulation, and the highest rate of finished products is taken as the end optimization goal. The thin film systems designed by this method not only satisfy the requirements of optical properties, but also have larger manufacturing tolerance. Therefore, this method will be very effective in production. Some examples of the designs of broad-band and double-band antireflection coatings are given. The results of these designs are satisfactory. (Paper received 12 Sep 86; revised 30 Oct 86.)

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CALCULATION OF ELECTRIC FIELDS INSIDE MULTILAYERS USING NEW THIN-FILM  
CHARACTERISTIC MATRIX METHOD

40090025 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 9,  
Sep 87 pp 832-837

[English abstract of article by Zheng Shuying [6774 5289 4481] of Beijing  
Institute of Opto-electric Technique; Han Liying [7281 7787 3841] of the  
Department of Applied Physics, Qinhua University]

[Text] A new thin-film characteristic matrix, with which the relationship between the normal component of  $D$  and the tangential component of  $E$  for a TM wave and between the normal component of  $B$  and the tangential component of  $H$  for a TE wave at the two boundaries of a layer can be described, is presented and used for calculation of electric field distributions inside multilayers. As a consequence, very simple expressions for the electric fields of TM and TE waves at any angle of incidence are obtained. The electric field distributions of a thin film polarizer and an induced reflection filter are calculated and plotted for illustration of the new matrix method. It is also shown that the dispersive equation of surface polaritons on multilayers may easily be derived using this method. (Paper received 8 Oct 86; revised 8 Jan 87.)

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FAST NEUTRON SPECTROMETER UTILIZING CROSS-OVER TIMING METHOD FOR n- $\gamma$  PULSE SHAPE DISCRIMINATION

40090030 Lanzhou LANZHOU DAXUE XUEBAO [JOURNAL OF LANZHOU UNIVERSITY] in Chinese Vol 23 No 3, 1987 pp 47-55

[English abstract of article by Ren Zhongliang [0117 1813 5328], et al.]

[Text] In this paper the main performance of a fast neutron spectrometer with a 1-15 MeV neutron energy range is reported. The cross-over timing method has been used for pulse shape discrimination, and the discrimination efficiency for  $^{88}\text{Yr}$  rays is 99.8 percent. A stilbene crystal scintillator ( $\phi 28 \times 21$  mm) is used. The scintillation photons are collected by a DARIO 56 AVP photomultiplier tube and the power supply for the PM tube is provided by a bridge circuit with two high voltage supplies. The spectrometer has energy resolution of 6.5 percent and efficiency >5 percent for 14 MeV neutrons.

The neutron spectrum of the T(d, n) reaction has been measured on the authors' 150 kV neutron generator at  $45^\circ$  to the direction of the deuteron beam. The resulting neutron energy is 14.42 MeV. The  $^{252}\text{Cf}$  spontaneous fission neutron spectrum has been measured. The spectrum is fitted with Maxwellian distribution and the nuclear temperature of 1.46 MeV is obtained. The  $^{241}\text{Am/Be}$  neutron spectrum has been measured.

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**INFLUENCE OF THERMAL ANNEALING ON OPTICAL PROPERTIES OF HYDROGENATED AMORPHOUS CARBON FILMS**

40090026 Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 6A No 5, Oct 87 pp 335-340

[English abstract of article by Chen Shuguang [7115 2885 0342], et al., of the Department of Physics, Zhongshan University]

[Text] Using spectroscopic ellipsometry, the influence of thermal annealing on optical properties of the plasma-deposited hydrogenated amorphous carbon films is investigated. The results show that the optical properties of these films change obviously under the condition of a 500°C annealing temperature. The refractive index is decreased at shorter wavelengths, and increased at longer wavelengths. The extinction coefficient, absorption coefficient and reflectivity are all increased gradually with an increase in the annealing temperature. However, the optical gap decreases gradually. These results are discussed.

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HOT ELECTRON EFFECTS IN FREE CARRIER PHOTOCONDUCTIVITY IN HgCdTe

40090026 Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH]  
in Chinese Vol 6A No 5, Oct 87 pp 341-346

[English abstract of article by Wang Weili [3769 1218 4409], et al., of the  
Department of Physics, Beijing University]

[Text] The research and observation of free electron absorption and photoconductivity in N-type  $\text{Hg}_{0.78}\text{Cd}_{0.22}\text{Te}$  at 100k have been made using a CW tunable  $\text{CO}_2$  laser. It is found that the photoexcitation gives rise to an increase in the hot electron temperature and a change in mobility. The analysis of experimental results shows that the ionized impurity scattering dominates variation of the mobility. The possibility exists for developing a new type of far infrared detector.

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PROGRESS IN MODULATION SPECTROSCOPY--MODULATION SPECTROSCOPY STUDY OF SEMI-CONDUCTORS AND THEIR SUPERLATTICES

40090026 Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH]  
in Chinese Vol 6A No 5, Oct 87 pp 369-386

[English abstract of article by Shen Xuechu [3088 1331 4342] of the Laboratory for Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] The physical basis for modulation spectroscopy, and especially for photoreflectance modulation spectroscopy, is illustrated. Their applications in the investigation and characterization of semiconductor mixed crystals and superlattices, ion-bombarding-laser annealing processes, superlattices and quantum wells of semiconductors are discussed. It has been demonstrated that photomodulation spectroscopy has become one of the most powerful and simplest tools for the investigation of the inter-subband transitions in the quantum well and the characterization of microstructures of semiconductor superlattices.

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METAL-SEMICONDUCTOR TRANSITION, SUPERCONDUCTIVITY IN La-Ba-Cu-O SYSTEM

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 177-179

[English abstract of article by Zhang Tao [1728 3447], et al., of the Department of Physics, University of Science and Technology of China, Hefei; Zhang Han [1728 6799], et al., of the Department of Applied Chemistry, University of Science and Technology of China, Hefei]

[Text] The temperature dependence of resistance of specimens with the nominal composition  $\text{Ba}_x\text{La}_{1-x}\text{Cu}_3\text{O}_{7-x}$  ( $x = 0, 0.25, 0.5, 1.0, 1.25, 1.5; y > 0$ ) was measured. It was found that the binary oxide with  $x = 0$  is a typical semiconductor, and the transition from semiconductor to semimetal and finally to metal (superconductor) occurs in this system as  $x$  increases. In addition, the critical temperature of superconducting transition  $T_c$  is elevated monotonously by increasing the concentration of Ba. From the results of the energy bands calculated by Mattheiss and Freeman, a qualitative explanation is given according to the strong electron-phonon coupling theory. It is suggested that the addition of divalent barium in  $\text{La}_2\text{CuO}_4$  suppresses the instability and stabilizes the superconducting phase. (Received 25 Apr 87.)

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MICROSTRUCTURE-PHYSICAL MODEL OF SENSITIVE SEMICONDUCTOR CERAMICS (I)

40090037 Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 10, Oct 87 pp 1298-1304

[English abstract of article by Nan Cewen [0589 4595 2429] of the Department of Silicate Materials Science and Engineering, Wuhan University of Technology]

[Text] Combining the improved effective-medium theory (EMT) with the features of sensitive semiconductor ceramics, the author proposes a simple and quantitatively physical model that can be used to describe the relationship between microstructure features and properties of sensitive semiconductor ceramics. The author uses this model to describe the electrical properties of nonlinear ZnO ceramics, and finds that the results of the model are consistent with both experimental results and the results obtained by the quantum theory of semiconductor conduction.

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MICROSTRUCTURE-PHYSICAL MODEL OF SENSITIVE SEMICONDUCTOR CERAMICS (II)

40090037 Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 10, Oct 87 pp 1305-1312

[English abstract of article by Nan Cewen [0589 4595 2429] of the Department of Silicate Materials Science and Engineering, Wuhan University of Technology]

[Text] In this paper, the author describes the electrical features of thermal-sensitive, gas-sensitive and humidity-sensitive ceramics by the microstructure-physical model of sensitive ceramics, obtaining some important results. These theoretical results are consistent with those of experiments, providing a basis for the theory of materials design of sensitive ceramics. The author reports that this model can be taken as the unified microstructure-physical model for this kind of semiconductor ceramics.

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HIGH  $T_c$  SUPERCONDUCTIVITY, M-S TRANSITION IN Ba-La-Cu-O SYSTEM

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 169-173

[English abstract of article by Zhao Yong [6392 0516], et al., of the Department of Physics, University of Science and Technology of China, Hefei; Qian Yitai [6929 6654 3141], et al., of the Department of Applied Chemistry, University of Science and Technology of China, Hefei]

[Text] The temperature dependence of resistance, a.c. susceptibility, specific heat, XPS and X-ray diffraction was measured respectively both in single-phase  $Ba_2YCu_3O_{9-\delta}$  and multi-phase  $Ba_xY_{1-x}CuO_{3-y}$  samples of different compositions prepared under various sintering conditions. The experimental results support the view that bulk superconductivity exists in these compounds. The authors also found that the  $Ba_2YCu_3O_{9-\delta}$  phase plays an important role in the superconductivity of the multi-phase samples, and the high density of the electronic state at the Fermi level is usually associated with high  $T_c$ . However, only 0.5 percent ( $x = 0.005$ ) Ba content still leads to high  $T_c$  superconductivity, which should not be attributed to the interface. As a result, the authors do not rule out the possibility that the Ba atom acts as an impurity in affecting the electronic structure, thereby leading to superconductivity. It has also been observed that the M-S (Metal-Semiconductor) transition, which may be driven by the electrons, occurs near  $x = 0$ . (Received 25 Apr 87.)

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**SUPERCONDUCTIVITY AND ITS STABILITY IN Y-Ba-Cu OXIDE PREPARED BY COPRECIPITATION FROM AQUEOUS SOLUTIONS**

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 180-182

[English abstract of article by Meng Xianren [1322 2009 0088], et al., of the Department of Physics, Beijing Normal University; Fu Minhua [0265 2404 5478], et al., of Beijing Institute of Chemical Technology]

[Text] Stable and reproducible high- $T_c$  superconductors with nominal composition  $Y_{0.6}Ba_{0.4}CuO_x$  have been prepared from aqueous solution using a coprecipitation method. The resistive transition starts from 95.1 K, and is completed at 92.6 K, with a mid-point transition temperature  $T_{cm} = 94.1$  K, and a transition width  $\Delta T_c = 1.2$  K. A sample has been treated with 20 cycles from liquid-nitrogen to room temperature and from liquid nitrogen to atmospheric ambiances. After one to three thermal cycles, the superconducting temperature dropped a little, stabilizing at about 91.5 K. Crystal structure of the sample both at normal state (at room temperature) and at superconducting state (at 77 K) has been determined by X-ray diffraction. Analysis shows that this compound is a double-phase polycrystal whose main phase is an orthorhombic, oxygen-deficient perovskite superstructure. No structural difference has been found between the normal state and the superconducting state, except for a little reduction of the lattice constants (for normal state,  $a = 3.806$  Å,  $b = 3.947$  Å,  $c = 11.862$  Å; for the superconducting state,  $a = 3.768$  Å,  $b = 3.922$  Å,  $c = 11.829$  Å). (Received 3 May 87.)

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## PRESSURE RESEARCH ON SUPERCONDUCTIVITIES OF Y-Ba-Cu AND Y-Gd-Ba-Cu OXIDES

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 187-189

[English abstract of article by Jin Bianjun [6855 3079 7586], et al., of the Department of Physics, Shanghai University of Science and Technology]

[Text] The pressure effect on the superconducting transition temperature for  $Y_1-Ba_2-Cu_3$  and  $Y_1-Gd_1-Ba_1-Cu_3$  oxides was research for up to 12 kbar between 77 and 300 K. The resistance measurements were carried using a standard DC four-lead technique. The pressure environment was provided by a Be-Cu clamp with a fluid medium. Pressure enhanced the superconducting transition temperature  $T_{ci}$  (onset temperature) and  $T_{cf}$  (the temperature at which resistance disappears) for these two materials, with  $\Delta T_{cf}/\Delta p = 0.71$  K/kbar for the Y-Ba-Cu oxide and 0.27 K/kbar for the Y-Gd-Ba-Cu oxide. The resistivity  $\rho_{ci}$  at  $T_{ci}$  is depressed by pressure for Y-Ba-Cu oxide. (Received 5 May 87.)

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**EFFECT OF CRYSTAL STRUCTURE DISTORTION ON SUPERCONDUCTIVITY IN Y-Ba-Cu-O COMPOUNDS**

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 190-193

[English abstract of article by Jiang Xiaoping [3068 2556 1627], et al., of the Institute of Metal Research, Chinese Academy of Sciences, Shenyang]

[Text] In this report, the influence of lattice distortion caused by differing treatments following sintering (different cooling rates and aging in various environments) on superconductive behavior in the Y-Ba-Cu-O system has been studied. It has been found that the reversal phenomenon of intensities for three pairs of main X-ray diffraction peaks in the orthorhombic layered perovskite occurred gradually with the increasing of cooling speeds after sintering, and it was accompanied by the changing superconductivity of the specimens. In addition, it has also been found that strong interaction exists between the superconductor and polarization molecules, such as  $H_2O$ ,  $CO$ , etc., making changes in X-ray diffraction peak intensities similar to those of the above treatments and causing the sample to lose superconductivity at the liquid nitrogen temperature. It is indicated that the lattice distortion of the orthorhombic phase is closely linked to the superconductivity of the Y-Ba-Cu-O ceramics, and a quantitative relationship between them has been found based on the analysis and calculation of the experimental results. In addition, a preliminary explanation of the relationship between lattice distortion and superconductivity has been made with the help of the polarization theory and crystal field model. (Received 7 May 87.)

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HIGH- $T_c$  Y-Ba-Cu-O SUPERCONDUCTOR COATING

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 198-200

[English abstract of article by Hu Qingyu [5170 0282 1342], et al., of the Institute of Metal Research, Chinese Academy of Sciences, Shenyang]

[Text] A high- $T_c$  Y-Ba-Cu-O superconductor coating has been prepared using the plasma spray technique with a critical temperature onset at 101 K and zero resistance at 86 K. The results of resistance and susceptibility measurements show that the coating sample has similar superconducting properties to those of the bulk superconductor. X-ray diffraction and EPM analysis indicate that the coating consists of  $YBa_2Cu_3O_{9-x}$  single phase compound and more trace phases. (Received 7 May 87.)

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DETERMINATION OF STOICHIOMETRY OF Y-Ba-Cu-O SUPERCONDUCTORS BY RUTHERFORD BACKSCATTERING AND NUCLEAR REACTION

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 201-203

[English abstract of article by Cheng Huansheng [2110 3562 3932], et al., of Fudan University, Shanghai]

[Text] The stoichiometry of Y-Ba-Cu-O superconductors has been measured by Rutherford backscattering and the nuclear reactions  $^{16}\text{O}(\text{D},\text{P}_1)^{17}\text{O}$ . Experimental results show that the real composition of a superconductive sample may be different than that of nominal composition. The relative concentrations of Y and O to Cu in superconductive samples are apparently lower than those of nonsuperconductive samples. The front surface of a sample could be superconductive after being exposed to an oxygen flow during sintering, resulting in the rear surface being nonsuperconductive, but the oxygen content in the salvage of the front side should be lower than that of the rear side. These results imply that the appearance of superconductivity depends on the stoichiometry of the material rather than relying on the nominal composition. Therefore, it is quite likely that, in order to obtain superconducting materials of good quality, the composition should be determined experimentally. (Received 7 May 87.)

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## SUPERCONDUCTIVITY OF FOUR-COMPONENT Y-U-Ba-Cu OXIDE SYSTEM

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 204-206

[English abstract of article by Qin Qizong [4440 0796 1350], et al., of Fudan University, Shanghai]

[Text] The four-component system of Y-U-Ba-Cu oxides was prepared from a mixture of  $Y_2O_3$ ,  $U_3O_8$ ,  $BaCO_3$ , and  $CuO$ . This is the first time a report has been released indicating that the actinide element can be used as a component of the high  $T_c$  superconductor. The zero resistance temperatures of the two samples with nominal composition of  $Y_{1.05}U_{0.1}Ba_{0.8}CuO_{4-y}$  and  $Y_{1.1}U_{0.1}Ba_{0.8}CuO_{4-\delta}$  are 79.0 K and 86.7 K, respectively. The X-ray diffraction study of the Y-U-Ba-Cu-O system implies that a new compound may be formed. None of the lines could be fitted to the uranium oxides and the other raw material structures. The X-ray powder pattern for this new compound is different from the  $K_2NiF_4$ -type layered perovskite and  $YBa_2Cu_3O_{9-x}$  structure. (Received 7 May 87.)

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HIGH  $T_c$  SUPERCONDUCTIVITY IN  $Ba_xY_{1-x}CuO_{3-y}$  SERIES

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS]  
in Chinese Vol 9 No 3, Sep 87 pp 216-218

[English abstract of article by Dong Ziwen [5516 1311 2429], et al., of the  
Institute of Physics, Chinese Academy of Sciences, Beijing]

[Text] The authors have investigated various compositions of the  $Ba_xY_{1-x}CuO_{3-y}$  system, resulting in the observation of high and sharp superconducting transitions in ac susceptibility and resistance with a zero-R state above 90 K and R-transition widths about 3 K, for a wider composition range of  $0.50 \leq x \leq 0.80$ . For x below 0.50, the midpoint temperature of resistive transitions ( $T_{c1/2}$ ) is monotone, increasing with the composition x. AC susceptibility measurements indicate that all onset  $\chi$ -transition temperatures are close to that of the R-transition. X-ray analysis reveals that the pure single-phase compound corresponds to a nominal composition  $Ba_{0.65}Y_{0.35}CuO_{3-y}$ , while the others ( $x = 0.50, 0.60, 0.70, 0.75$  and  $0.80$ ) approximate the single-phase. Compounds with the single-phase structure of oxygen defect-perovskite, which may be of an orthorhombic type, always exhibit a high  $T_{cL}$  superconductivity. (Received 9 May 87.)

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SUPERCONDUCTIVE PHASES IN Ba-Y-Cu-O SYSTEM

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 233-235

[English abstract of article by Cao Liezhao [2580 3525 0340], et al., of the Department of Physics, University of Science and Technology of China, Hefei]

[Text] The authors have measured the ac susceptibility of several samples in the Ba-Y-Cu-O system and have found two superconductive phases in the same sample. The higher  $T_c$  superconductive phase increases and the lower  $T_c$  superconductive phase decreases when the yttrium content is decreased. The lower  $T_c$  phase disappears when the Ba:Y ratios are larger than 1.6:1.4. The X-ray powder diffraction patterns for four samples are shown, and the same results as above are indicated. In addition, the temperature dependence of the backing signals for the copper holder and sapphire holder are shown. A much smaller backing signal was obtained for the sapphire holder. (Received 8 May 87.)

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SUPERCONDUCTOR WITH ZERO RESISTANCE AT 96 K IN  $Y_{0.4}Ba_{0.6}CuO_{3-\delta}$  AND ITS INSTABILITY

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 243-244

[English abstract of article by Cao Xiaowen [2580 2400 2429], et al., of the Institute of Plasma Physics, Chinese Academy of Sciences, Hefei; Tang Honggao [3282 3163 7559], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei]

[Text] A  $Y_{0.4}Ba_{0.6}CuO_{3-\delta}$  superconductor with a zero resistance superconducting transition temperature of 96.3 K and midpoint transition temperature of 97.6 K has been obtained. It was found that the superconductivity was degraded step-by-step after undergoing cool-warm cycles and frost on the surface. (Received 12 May 87.)

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## SUPERCONDUCTING OXIDE GROUP WITH ZERO-RESISTANCE TEMPERATURE ABOVE 90 K

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 245-247

[English abstract of article by Zhang Qirui [1728 0366 3843], et al., of the Department of Physics, University of Science and Technology of China, Hefei; Qian Yitai [6929 6654 3141], et al., of the Department of Applied Chemistry, University of Science and Technology of China, Hefei]

[Text] Seven ABO<sub>3</sub>-type structure superconducting oxides Sr<sub>0.4</sub>Y<sub>0.6</sub>CuO<sub>3-y</sub> and Ba<sub>0.4</sub>Ln<sub>0.6</sub>CuO<sub>3-y</sub> (Ln is Y, Tm, Dy, Gd, Er and Yb, respectively) have been successfully synthesized, with their zero-resistance temperature exceeding 90 K. The resistivity measurements show that both the R(T) behavior and the high T<sub>c</sub> superconducting transition of each sample are in accord, although the component atoms A in each oxide are obviously different in their outer shell electrons. However, the ac susceptibility measurements show the difference of the M(T) behaviors in the normal state which might be due to the difference in the magnetic atoms A. The authors argue that the Cu-O bonds within the ABO<sub>3</sub>-type structure frame play an important role in the electronic properties in these superconducting oxides. Also, there is a strong interaction between the electrons in this structure. The magnetic scattering of the electron is not strong enough to destroy the high T<sub>c</sub> superconductivity. (Received 13 May 87.)

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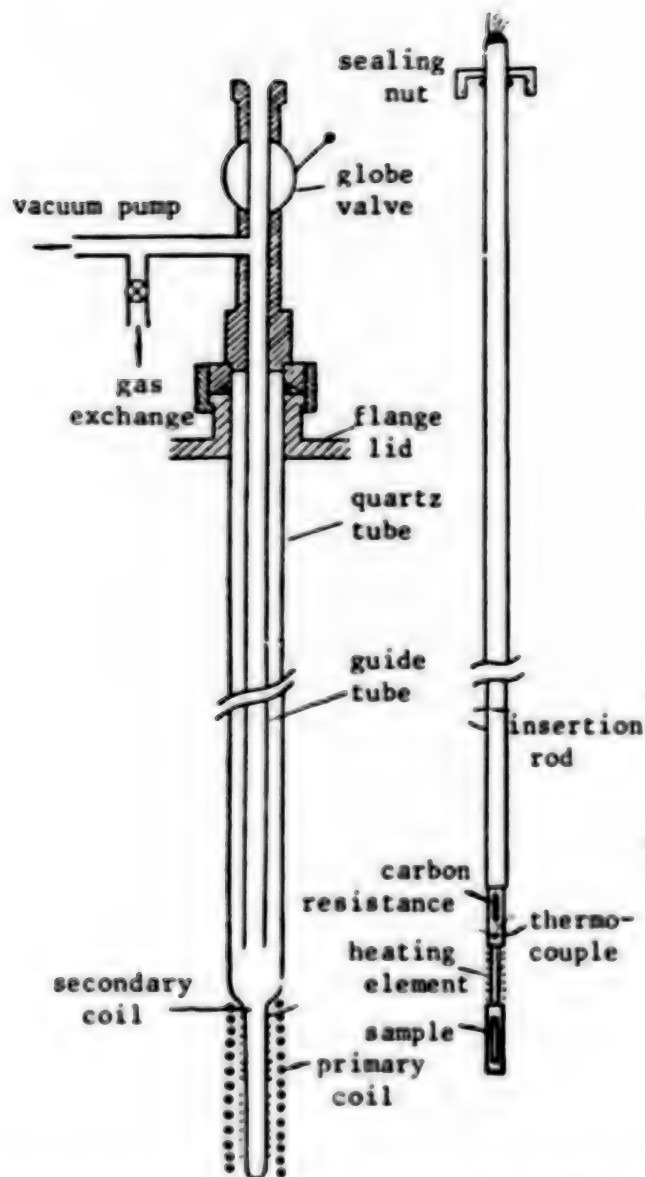
AC MAGNETIC SUSCEPTIBILITY MEASUREMENTS FOR OXIDE SUPERCONDUCTORS

40090029 Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 9 No 3, Sep 87 pp 248-250

[English abstract of article by Cao Liezhao [2580 3525 0340], et al., of the Department of Physics, University of Science and Technology of China, Hefei]

[Text] A top loading apparatus (see figure) has been established for the ac susceptibility measurements of the oxide superconductors (Ba-Y-Cu-O, Sr-Y-Cu-O, etc.). A mutual inductance bridge was employed for the susceptibility measurements. The temperature was determined with a copper-constant thermocouple and an Allen-Bradley carbon resistor in the 4.2-300 K temperature range. The temperature dependence of susceptibility of the Ba-Y-Cu-O sample is shown. The observed ac susceptibility signal is expressed as the difference in the mutual inductance of the sensing coil with and without the specimen charged in it. The backing signal due to the copper holder has been calculated. The temperature dependence of the backing signal comes from the temperature dependence of the resistance of the copper. The big change in this signal is between 40 K and 80 K, which is consistent with the measurement of the backing signal. (Received 16 Apr 87.)





AC Susceptibility Measuring Device and Sample Insert

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PREPARATION, SUPERCONDUCTIVITY IN NEW HIGH-T<sub>c</sub> SUPERCONDUCTOR Y-Ba-Cu-Ag-O\*

40090041 Beijing BEIJING DAXUE XUEBAO in Chinese No 6, 1987 pp 122-123

[English article by Liu Huizhou [0491 2585 3166], et al., of the Department of Chemistry, Beijing University]

[Text] Abstract: A new high-T<sub>c</sub> (~90 K) superconductor, Y-Ba-Cu-Ag-O, has been prepared. The results reveal that in the Y-Ba-Cu-Ag-O system, copper can be replaced by Ag atoms up to a certain percentage. However, when the percentage of Ag is too high, the system loses its superconductivity at liquid nitrogen temperature.

Following the earlier discovery of high-T<sub>c</sub> superconductivity in the Y-Ba-Cu-O system<sup>[1-3]</sup>, superconductivity has been discovered in many systems, including Ln-Ba-Cu-O (Ln=Sm-Lu) and RE-Ba-Cu-O. Now, we are studying whether copper can be replaced by other transition metals in the Y-Ba-Cu-O system. We have prepared a new high-T<sub>c</sub> superconductor, Y-Ba-Cu-Ag-O, and the superconductivity of the system has been characterized.

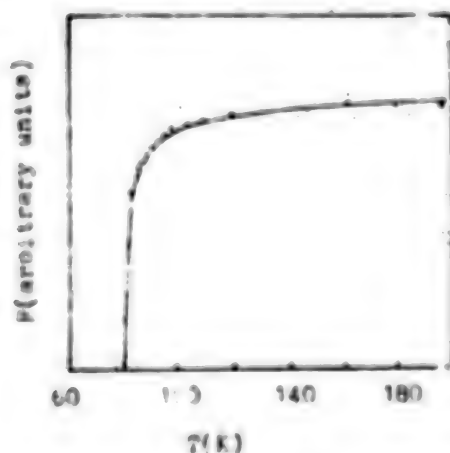


Figure 1. Electrical Resistance vs Temperature for YBa<sub>0.3</sub>Cu<sub>0.7</sub>Ag<sub>0.7</sub>O Sample

The Y-Ba-Cu-Ag-O samples were prepared from mixtures of high purity Y<sub>2</sub>O<sub>3</sub>, BaCO<sub>3</sub>, Ag<sub>2</sub>O and Cu powders. After thorough mixing, the powders were heated

for 6 hours in air at 800°C, then pressed into a thin disk. The disk was heated for 12 hours at 850-900°C. Four-terminal resistance measurements were performed on these samples. Typical results are shown in Figure 1. The superconducting transitions are very similar, with midpoints in the 90 K range.

Table 1 shows the superconductivity as a function of the Cu/Ag ratio. The results reveal that in the Y-Ba-Cu-Ag-O system, we can replace copper with Ag up to a certain percentage. However, when the percentage of Ag is too high, the system loses its superconductivity at liquid nitrogen temperature.

Table 1. Physical Properties Data

Y:Ba:Cu:Ag:O	Color	Superconductivity (above 77 K)
1:7:8:4:x	brown	No
1:3:3.5:0.5:x	black	Yes
1:4.5:5:0.7:x	black	Yes

\* Project supported by the National Natural Science Foundation of China.  
Paper was received 3 July 87.

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UV EXCITED FLUORESCENCE SPECTRA OF HIGH- $T_c$  SUPERCONDUCTORS  $YBa_2Cu_3O_x$ ,  $YBaCu_2O_x$ \*

40090041 Beijing BEIJING DAXUE XUEBAO in Chinese No 6, 1987 pp 124-126

[English article by Lin Yingzhang [2651 2019 4545], et al., of the Department of Chemistry]

[Text] Abstract: The fluorescence studies on high- $T_c$  superconductors  $YBa_2Cu_3O_x$  (I) and  $YBaCu_2O_x$  (II) have been carried out at 77 K and 298 K. A broad emission band at 390 nm is observed in both systems. Their excitation spectra have also been determined.

Following the earlier discovery of high- $T_c$  superconductivity in the La-Ba-Cu-O system [1], superconductivity in the 90-K range has also been discovered in the Y-Ba-Cu-O system [2-3]. Some mechanisms for superconductivity have been proposed recently [4]. However, little work has been done involving the electronic structure and atomic valence for these superconductors. We have now carried out fluorescence studies on the high- $T_c$  superconductors  $YBa_2Cu_3O_x$  (I) and  $YBaCu_2O_x$  (II) in order to explore the electronic transition properties of these superconducting cuprate oxides.

The samples were prepared in our laboratory and examined by the X-ray diffraction method. Four-terminal dc resistance measurements were performed on these samples. Some results are shown in Figure 1.

The emission spectra of (I) and (II) at 298 K and 77 K are shown in Figures 2 and 3, respectively. It is clear that there is a broad emission band at 390 nm in both systems. This band is also found in the X-ray excited fluorescence spectra.

Their excitation spectra are shown in Figures 4 and 5. From these spectra we know that three excitation bands, 246 nm (vs), 275 nm (vw) and 308 nm (v), exist at room temperature. However, their intensities change greatly at 77 K. An explanation for this phenomenon and its relationship to superconductivity is now under investigation.

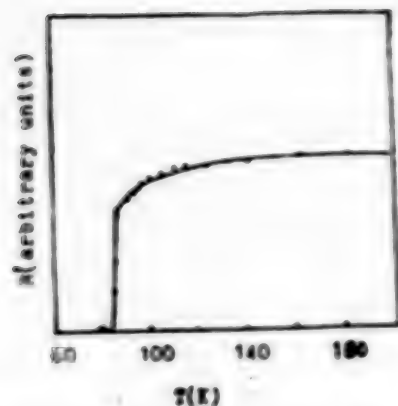


Figure 1. Resistivity vs Temperature for  $\text{YBa}_2\text{Cu}_3\text{O}_x$

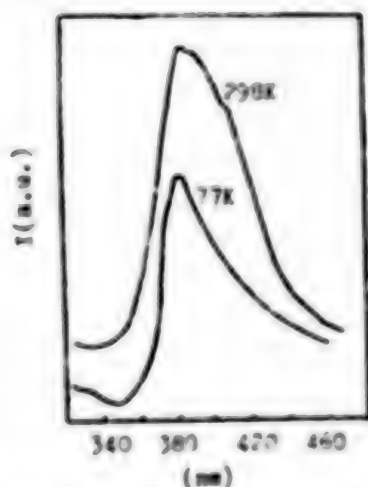


Figure 2. Emission Spectra of  $\text{YBa}_2\text{Cu}_3\text{O}_x$  ( $\lambda_{\text{ex}} = 254 \text{ nm}$ )

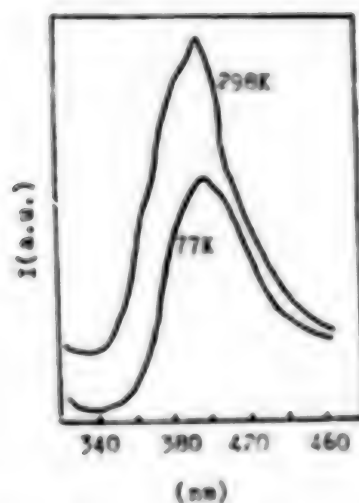


Figure 3. Emission Spectra of  $\text{YBaCu}_2\text{O}_x$  ( $\lambda_{\text{ex}} = 254 \text{ nm}$ )

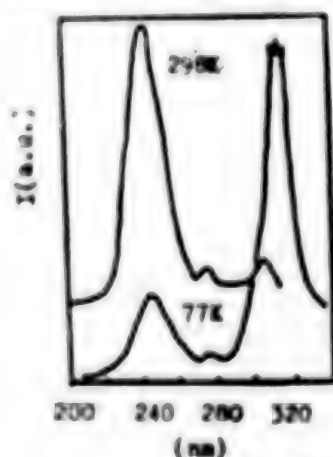


Figure 4. Excitation Spectra of  $\text{YBa}_2\text{Cu}_3\text{O}_x$  ( $\lambda_{\text{em}} = 390 \text{ nm}$ )

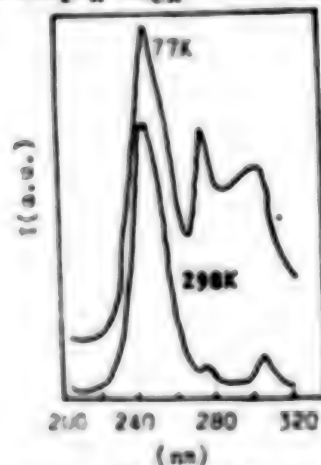


Figure 5. Excitation Spectra of  $\text{YBaCu}_2\text{O}_x$  ( $\lambda_{\text{em}} = 390 \text{ nm}$ )

\* Project supported by the National Natural Science Foundation of China.  
Paper received on 3 July 87.

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SOME EXPERIMENTAL RESULTS OF HIGH  $T_c$  Y-Ba-Cu-O SUPERCONDUCTORS

40090039 Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY] in Chinese  
Vol 26 No 3, Sep 87 pp 241-246

[English abstract of article by Hua Zhongyi [5478 0022 0001], et al., of  
Fudan University]

[Text] High  $T_c$  superconductors of the Y-Ba-Cu-O system with (Y+Ba):Cu = 1~2 have been investigated. Results show that any sample in this system with a proportion of Y:Cu between 0.6 and 1.2 is oxygen-deficient and will be superconductive after sintering in an oxygen flow. Their real compositions have been measured by Rutherford backscattering (RBS) and a nuclear reaction,  $^{16}\text{O}(d, p_1)^{17}\text{O}$ . High resolution electron microscopy (HREM) and X-ray diffraction patterns show that all these superconductors with different nominal compositions have a superconductive phase of perovskite-like  $\text{YBa}_2\text{Cu}_3\text{O}_7$  (Phase A), and the differences among the constituents are shown in another phase (Phase B), which acts as a gettering center. When the composition has an excess of Y, a third phase (Phase C) occurs, which has been identified as small particles of  $\text{Y}_2\text{O}_3$ . These results can be used for explaining some of the experimental phenomena.

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PREPARATION OF Y-Ba-Cu-O SUPERCONDUCTIVE COATINGS

40090039 Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY] in Chinese  
Vol 26 No 3, Sep 87 pp 253-256

[English abstract of article by Luo Weiang [5012 4850 2491], et al., of Fudan University]

[Text] Coatings of a Y-Ba-Cu-O compound have been prepared and their superconductivity has been investigated. Results show that the electrical resistivity of these coatings drops sharply around the temperature of 92K. The zero resistance temperature of all samples is above 77K, with the maximum being 88.2K. AC magnetic susceptibility measurements show a large diamagnetic signal appearing around the onset temperature. X-ray diffraction patterns indicate that, on an alumina substrate, the coating contains a single  $\text{YBa}_2\text{Cu}_3\text{O}_{9-x}$  oxygen-deficient perovskite-like structure.

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MEASUREMENT OF Au SPUTTERING YIELD WITH LOW ENERGY Ar ION BY BACKSCATTERING

40090034 Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 9, Sep 87 pp 1-4, 60

[English abstract of article by Hu Jiazeng [5170 0857 1073], et al., of Shanghai Institute of Metallurgy, Chinese Academy of Sciences; Zhu Dezhang [2612 1795 1757], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] Au sputtering yield with  $\text{Ar}^+$  ions of 300-1200 eV is measured by backscattering. The backscattering spectra are treated by two methods--the energy loss method and the area method. The results show that Au sputtering yield measured by RBS [Rutherford backscattering spectrometry] is in agreement with G.K. Wehner's results using the weight method. The relationship between this experiment's sputtering yield and ion energy is  $y \propto E^{0.4}$ . This energy relationship agrees well with P. Sigmund's theory when  $m = 0.3$ .

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STUDIES OF FRACTIONATION OF Cu ISOTOPES BY 27 keV Ar<sup>+</sup> SPUTTERING FOR Cu AND CuAu ALLOY

40090034 Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 9, Sep 87 pp 5-7, 60

[English abstract of article by Wang Zhenxia [3769 7201 6667], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] In this paper the authors report results of isotopic fractionation  $\delta_f(^{63}\text{Cu}, ^{65}\text{Cu})$  in both elemental Cu and binary alloy  $\text{Cu}_{0.7}\text{Au}_{0.3}$  during sputtering by an Ar<sup>+</sup> ion 27 keV). The present observations show that larger mass-dependent isotopic fractionation effects accompany the sputtering process: (1) For an elemental Cu target,  $\delta_f(^{63}\text{Cu}, ^{65}\text{Cu}) = 62 \pm 27$  per thousandth, for the binary alloy  $\text{Cu}_{0.7}\text{Au}_{0.3}$  target,  $\delta_f(^{63}\text{Cu}, ^{65}\text{Cu}) = (5.9 \pm 1.6)$  per thousandth; (2) Angular distributions of isotopic fractionations  $\delta_f(^{63}\text{Cu}, ^{65}\text{Cu})$  are similar in both Cu and  $\text{Cu}_{0.7}\text{Au}_{0.3}$ , but it is noted that for alloy sample (CuAu), the  $\delta_f(^{63}\text{Cu}, ^{65}\text{Cu}) < 0$  at  $\theta$  (angle of ejection)  $< 45^\circ$ . These results indicate that sputtering produces isotope fractionation and that there are differences in angular distributions of  $\delta_f$  for both the Cu target and the  $\text{Cu}_{0.7}\text{Au}_{0.3}$  target.

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MULTI-CHANNEL DATA ACQUISITION, PROCESSING SYSTEM FOR MÖSSBAUER SPECTROSCOPY

40090034 Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 9, Sep 87 pp 8-14, 4, 61

[English abstract of article by Jin Ge [6855 7245], et al., of the University of Science and Technology of China]

[Text] A multi-channel data acquisition and processing system for Mössbauer spectroscopy is described which consists of an intelligent interface and a BC3-80 microcomputer.

The system has eight data channels, with each channel containing a counting circuit and a memory. A Z80-CPU is used as a main unit for control and access. The microcomputer is used for real-time spectrum display, saving the data on a disk, printing data and data processing.

The system is applicable to a high counting rate multi-wire proportional chamber. It can greatly increase the counting rate for measuring the Mossbauer spectrum. The signals of each wire in the chamber go through a corresponding amplifier and a differential discriminator, and are recorded by a corresponding data channel. The data of each channel is then added by the microcomputer. In addition, two channels can be used to measure an absorption and a scattering spectrum at the same time, and obtain the internal and surface information of the sample simultaneously.

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**AUTOMATIC DATA ACQUISITION, PROCESSING FOR POSITRON ANNIHILATION LIFETIME SPECTRA, DOPPLER BROADENING SPECTRA**

40090034 Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 9, Sep 87 pp 36-39, 63

[English abstract of article by Teng Minkang [3326 2404 1660], et al., of Nanjing University]

[Text] The automatic data acquisition and processing technique for positron annihilation lifetime spectra and Doppler broadening spectra described in this paper is designed to facilitate the transfer of spectral data between the Canberra Series 40 or Series 35 MCA and IBM-PC/XT computer systems. The important features of the spectral data processing technique include display, calculations, spectrum and result storage/retrieval on disk, graphics and lists of results.

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PRINCIPLE, MECHANISM OF PLANETARY TARGET NEUTRON GENERATOR

40090034 Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 10 No 9, Sep 87 pp 49-50, 48, 64

[English abstract of article by Zhang Guanghua [1728 0342 5478] of the Institute of Modern Physics, Chinese Academy of Sciences]

[Text] The principle and mechanism of a planetary target is presented. At present, the T-Ti target employed in neutron generators can only be used on a ring-shape zone since they turn around their axes and the velocity in the central region is near zero. In this design, the track formed by beam hitting is an abnormal cycloid that is not repeated. In this case, the central region of the target has a larger velocity and the full target surface can be used. Therefore, the lifetime of the target is much longer.

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INVESTIGATION OF IREB PROPAGATION IN LOW PRESSURE NEUTRAL GASES

40090023 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 1, Mar 87 pp 8-15

[English abstract of article by Wang Xiaojun [3769 2400 6571], et al., of the Institute of Atomic Energy, Beijing]

[Text] Experimental and theoretical results of Intense Relativistic Electron Beam (IREB) propagation in low pressure neutral gases are presented. For an electron beam of 660 kV, 40 kA and 100 ns in pulse width, FWHM, injected into a drift tube filled with  $H_2$  and  $N_2$ , the pressure region in which IREB can be propagated efficiently is at  $P = (0.7-6.7) \times 10^2$  Pa, and a propagation efficiency of up to 80 percent has been obtained. At very low pressure ( $P = 13.3$  Pa), due to the spatial charge effect, the beam electrons are stagnated by a virtual cathode and expand radially, resulting in low propagation efficiency. At relatively high pressure, in addition to the electromagnetic field and the electron's Coulomb scattering by gas molecules, plasma instability would result in a decrease in propagation efficiency. Simulation of charge neutralization using the Monte-Carlo and current neutralization processes using numerical analysis have been done, and explanations of the experimental results have also been made.

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STUDIES OF IREB PROPAGATION IN VACUUM TUBE

40090023 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 1, Mar 87 pp 16-19

[English abstract of article by Wang Xiaojun [3769 2400 6511], et al., of the Institute of Atomic Energy, Beijing]

[Text] Experimental results of IREB (40 kA, 88 kV, and 100 ns in pulse width, FWHM) propagation in a vacuum drift tube without an external magnetic field are presented. It is experimentally confirmed that during propagation of IREB the phenomenon of net current multiplication takes place and L.S. Bogdankevich, et al.'s theoretical estimate of space charge limiting current is reasonable. The phenomena of net current multiplication and its significant delay, rise-time-shortening and pulse-width-narrowing are explained theoretically.

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ELECTRON CYCLOTRON RESONANCE PREIONIZATION EXPERIMENT ON HT-6B TOKAMAK

40090024 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 3, Sep 87 pp 160-165

[English abstract of article by Zhan Rujuan [6124 1172 1227], et al., of the Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, Anhui]

[Text] In this paper, the results of the second harmonic electron cyclotron resonance (ECR) preionization experiment on the HT-6B tokamak are reported. In the experiment, the microwave from a gyrotron (frequency 35 GHz, power 15-20 kW, pulse length 0.5-2 ms, circularly polarized  $TE_{0,2}^0$  mode) is injected from the lower field side into the torus at 200  $\mu$ s or 400  $\mu$ s before the application of Ohmic heating power. The experiment results show that ordinary discharge waveforms can be obtained as long as the ECR-layer is located inside the torus and no breakdown delay is observed. The reduction of peak loop voltage is more than 30 percent. The radiation intensity of the light impurity C IV and hard X-ray emission are also reduced noticeably.

9717

USING VUV LINES IN ION TEMPERATURE MEASUREMENTS AND OBSERVATION OF INSTABILITY ON HL-1 TOKAMAK

40090024 Chongqing HEJUBIAN YU DENG LIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 3, Sep 87 pp 141-146

[English abstract of article by Li Kehua [2621 0668 5478], et al., of the Southwestern Institute of Plasma, Leshan, Sichuan]

[Text] Photoelectric measurements using impurity line radiations in the vacuum ultraviolet from the HL-1 tokamak plasma are described. The ion temperature has been estimated to be around 80-300 eV, based on the measurement of the profiles of Doppler-broadened O VI 1032 Å lines. The stable operation conditions and disruption instability on the HL-1 are analyzed from the variation of relative intensities of the lines.

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ON THE NATURE OF LONG DISCHARGES IN HL-1 TOKAMAK

40090023 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 1, Mar 87 pp 20-26

[English abstract of article by Li Youyi [2621 2589 1355], et al., of Southwestern Institute of Physics, Leshan, Sichuan]

[Text] The long discharges obtained during test operation of the HL-1 tokamak in 1985 are analyzed. The computed results of a zero-dimensional code based on a simplified runaway model are found to be consistent with most of the experimental phenomena observed. It seems plausible that the long tail of the discharges is dominated by runaway electrons.

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PRELIMINARY MEASUREMENTS OF TOKAMAK KT-5

40090023 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 1, Mar 87 pp 27-30

[English abstract of article by Wen Yizhi [5113 0001 0037], et al., of the Department of Modern Physics, University of Science and Technology of China]

[Text] A small tokamak, KT-5, has been in operation since 1984. The major and minor radii of the plasma are 30 and 4.5 cm, respectively. The parameters obtained during the first phase of KT-5 experiments are as follows:  
 $B_i = 0.45T$ ,  $I_p \geq 5$  kA,  $q(a) < 3$  and  $T_0 = 50$  eV.

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PREPARATION OF SINGLE-PHASE, MULTIPHASE Y-Ba-Cu-O

40090039 Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY] in Chinese  
Vol 26 No 3, Sep 87 pp 247-251

[English abstract of article by Miao Baicai [4924 2672 6299], et al., of the  
Department of Physics, Fudan University]

[Text] The preparations of single-phase and multiphase Y-Ba-Cu-O system  
superconductors are presented. X-ray diffraction patterns and high resolution  
electron microscopy show that the samples with a nominal composition of  
Y:Ba:Cu = 1:2:3 can be single-phase, and their structures are orthorhombically  
distorted perovskite. Samples of other compositions are multiphase.

The superconductivity of the sample is detected by four-probe resistance and  
AC susceptibility measurements. The zero resistance temperatures are  
approximately 90K.

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ANNEALING BEHAVIOR OF DEFECTS, LIFETIME CONTROL IN ELECTRON-IRRADIATED SILICON

40090040 Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY] in Chinese  
Vol 26 No 3, Sep 87 p 312

[English abstract of article by Wang Fangping [3769 2455 1627], et al., of the Department of Physics, Fudan University; Zhang Zengguang [1728 2582 0342] of the General Rectifier Factory of Shanghai]

[Text] A study of the defect annealing behavior and lifetime control in an electron-irradiated Si p<sup>+</sup>-n junction has been carried out. There are two annealing mechanisms involved in the annealing process of the divacancies--one dominates in the lower temperature range and the other dominates in the higher temperature range. The activation energy of defect E<sub>1</sub> (E<sub>C</sub>-0.37 eV) is found to be 1.7 eV, and the frequency factor is 2.8 x 10<sup>9</sup> s<sup>-1</sup>. The centers responsible for the lifetime control are divacancies and defect E<sub>1</sub>.

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EXPERIMENTAL INVESTIGATION OF TURNING-POINT CONVERGENCE ZONES IN DEEP SOUND CHANNEL IN SOUTH CHINA SEA

40090036 Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 6, Nov 87 pp 417-423

[English abstract of article by Gong Min [7895 2404], et al., of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] In October 1983, a comprehensive experiment was carried out to investigate the characteristics of turning-point convergence zones and of underwater sound propagation in a deep sound channel in the South China Sea using explosive sound sources. In this paper, the experimental results for the source at depths of 200 m and 500 m are presented. By using the theory of the turning-point convergence zone and the parabolic approximation, the measured data are analyzed. For low frequencies, measured positions of zones and convergence gains agree very well with calculated results. (Received 13 Apr 85.)

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ON FREQUENCY PROPORTIONAL CONVERSION OF LONGITUDINAL TRANSDUCER DESIGN

40090036 Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 6,  
Nov 87 pp 424-432

[English abstract of article by Yu Hongpei [0205 1347 3099] of Hangzhou  
Underwater Acoustics Institute]

[Text] In this paper a transformation net matrix is used to represent the characteristics of each vibrational part of a transducer, and the inherent relationship between mechanical quantities (velocity and force) and electrical quantities (voltage and current) is determined. Since matrix coefficients are the function of  $kl$  ( $k$  is the wave number and  $l$  is the length of each part), after adjusting the length in proportion to frequency while keeping  $kl$  as a constant, the new transducer produced will reserve all the characteristics of the original reference transducer. Its changed performance parameters can be obtained by using a conversion proportional factor. Therefore, this paper offers a convenient method and corresponding theoretical base for designing a longitudinal vibration transducer. A practical example, using a general purpose design program, is tested at the end of the article. (Received 16 Feb 85.)

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VARIATIONAL ANALYSIS OF SAW PIEZOELECTRIC COUPLING COEFFICIENT, SHORT-CIRCUIT METAL STRIP GRATING

40090036 Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 6, Nov 87 pp 433-441

[English abstract of article by Chen Dongpei [7115 2639 1014] of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] A variational expression of the angular frequency  $\omega^2$  is proposed for surface acoustic waves (SAW) propagating on both free and metallized surfaces of piezoelectric crystals. From this expression, an analytical solution for SAW piezoelectric coupling coefficient  $K^2$  can be derived as a function of the piezoelectric crystal constants. A comparison of the variational evaluations of  $K^2$  with the exact data obtained by a computer iterative algorithm shows the applicability of this expression as a guide for estimating  $K^2$  of the piezoelectric crystals. In addition, by means of a combination of this expression with the coupling-of-modes theory, analysis of the short-circuit metal strip grating can be simplified significantly. The SAW reflectivity of a single strip in the grating will be case into closed form functions of material constants and strip geometric parameters. The reflectivity results correctly explain the results of published experiments and, in particular, the phase behavior of reflectivities of different strip film and substrate configurations. The numerical results of reflectivities are in agreement with the published experimental data. (Received 4 Mar 85.)

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EXTENDED KALMAN FILTER FOR PASSIVE LOCALIZATION

40090036 Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 12 No 6,  
Nov 87 pp 450-459

[English abstract of article by Wu Guoqing [0702 0948 3237] of the Institute  
of Acoustics, Chinese Academy of Sciences]

[Text] An extended Kalman Filter (EKF) combined with the Linear Minimum Variance method is utilized for post-processing of passive localization. The combination of the two methods reduced bias and variance significantly, and overcomes the shortcoming of poor initial condition causing a big estimate error in EKF. A basic assumption concerning source motion is to consider it to be of constant velocity over successive observation intervals. The maneuvering portions are modeled as random velocity perturbation. An adaptive technique is able to track the maneuvering target. Computer simulation results show good performance in estimating range, speed target course and adaptation to target maneuver. (Received 11 Mar 85.)

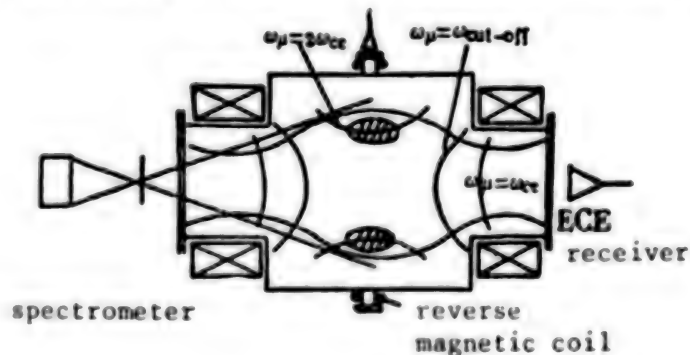
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## BASIC FEATURES OF HOT ELECTRON PLASMA IN SIMPLE MIRROR

40090024 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 3, Sep 87 pp 151-154

[English abstract of article by Huang Chaosong [7806 2600 2646], et al., of the Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, Anhui]

[Text] A hot electron plasma in a simple mirror is investigated experimentally. Microwaves ionize the gas and produce a cold plasma at the fundamental cyclotron resonance layer. A hot electron ring is formed by the second harmonic resonance heating. The cold plasma drives low frequency interchange modes and drift waves, while the hot electrons drive high frequency interchange modes. Stabilizing effects on the fluctuations are observed.



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STUDY OF EFFECTS OF HYDROGEN ION BOMBARDMENT ON STRUCTURE, INTERFACE OF TiC FILMS

40090024 Chongqing HEJUBIAN YU DENGLIZITI WULI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 7 No 3, Sep 87 pp 176-179, 186

[English abstract of article by Yao Weiguo [1202 0251 0948], et al., of the Institute of Solid State Physics, Chinese Academy of Sciences, Hefei, Anhui; Yu Zengliang [0151 1073 0081], et al., of the Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, Anhui]

[Text] The effects of hydrogen ion bombardment on TiC films coated on steel surfaces were studied. The hydrogen ion beam was supplied by a 5A pulse ion source with ion energy of 25 keV and pulse duration of 20 ms. After hydrogen ion bombardment, it was found that (1) no obvious damage was observed on the surface of the TiC films; (2) the hydrogen content in the TiC film was higher than that in a sample of substrate without coating; (3) the texture built up during the previous sputtering process disappeared; and (4) the adhesion between the film and substrate was enhanced.

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HOT CARRIER RELAXATION PROCESSES IN GaAs-GaAlAs MULTIPLE QUANTUM WELL STRUCTURES

40090037 Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 10, Oct 87 pp 1330-1335

[English abstract of article by Xu Zhongying [1776 0112 5391], et al., of the Institute of Semiconductors, Chinese Academy of Sciences]

[Text] Using the nonlinear luminescence correlation technique, a new time-resolved optical spectroscopy technique has been developed and applied to investigate hot carrier relaxation processes in GaAs-GaAlAs multiple quantum well structures. It has been found that the well width has a significant effect on the relaxation processes. For a sample with  $L_z = 40\text{\AA}$ , the time constant of the LO-phonon relaxation was found to be as long as 40 ps. The physical mechanism of this weakened electron-phonon interaction is also discussed.

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ORBIT ACCURACY REQUIREMENT OF GPS FOR PRECISE POSITIONING AND ORBIT DETERMINATION WITHIN LOCAL AREA

40090038 Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 28 No 3, Sep 87 pp 226-236

[English abstract of article by Xu Qifeng [6079 0366 7685] of Zhengzhou Institute of Surveying and Mapping]

[Text] The Global Positioning System (GPS) provides a new possibility for solving some problems relating to geodesy and geodynamics. As one powerful approach, the interferometric technique can be used for precise positioning without any knowledge of the precise code. As a matter of fact, it is difficult to get the ephemeris with a suitable accuracy, which is necessary for data processing. Therefore, the author discusses (1) required accuracy of satellite position for precise positioning and (2) satellite orbit accuracy obtainable within a local area, such as China.

Currently, an empirical formula is applied to estimate the influence of orbit error on baseline determination. In this paper an analytical formula is derived and some simulations are given. These show that the analytical formula is more precise than the empirical formula. Then, according to the formula, an appropriate orbit accuracy is obtained through statistics within the China area.

The advantages of GPS satellite distribution for orbit determination within a local area are discussed. Then the mathematical model of GPS orbit improvement using the interferometric technique and some simulation results relating to the geographic circumstances of China are given. These show that the satellite orbit obtained within China is sufficient for baseline determination with an accuracy of  $10^{-6}$  or better.

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## ON ERROR EQUATIONS FOR DETERMINING EARTH ROTATION PARAMETERS WITH VLBI NETWORK

40090038 Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 28  
No 3, Sep 87 pp 282-287

[English abstract of article by Xia Yifei [1115 0001 7378] of the Department  
of Astronomy, Nanjing University]

[Text] In this paper the partial derivative matrix in the error equation for determining the earth's rotation parameters with the VLBI network is described and the effect of the functional parameter constraint on solving the earth's rotation parameters is discussed. It points out that (1) the expression for the delay and delay rate for computing partial derivatives should be in explicit function form of source position parameters in the space-fixed coordinate system and the baseline parameters in the body-fixed coordinate system. If the following expression of delay is adopted

$$\tau = -\frac{B}{c} [\sin\varphi_B \sin\delta + \cos\varphi_B \cos\delta \cos(S_G + \lambda_B - \alpha)],$$

then the Celestial Ephemeris Pole will be used as the uniform pole for the space-fixed and body-fixed coordinate systems, (2) the baseline parameters and clock polynomial coefficients must be examined before determination of the earth's rotation parameters since they correlate highly, and (3) the functional parameters constraint imposed in the least squares adjustment may reduce the correlation of the earth's rotation parameters with the baseline parameters and clock polynomial coefficients. All those parameters can be solved together and the precision of solving the earth's rotation parameters can be increased if the functional parameter constraint is applied.

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## BRIEFS

ERICSSON, PLESSEY SUPPLYING ADVANCED TELECOM EQUIPMENT TO PRC--Ericsson is supplying the People's Republic of China with telephone exchanges worth 92 million guilders. Plessey has obtained a 21-million guilder order from this same country. The Ericsson order, which also includes the installation of China's first mobile telephone network, has four parts. Bidirectional switching exchanges will be installed in Guangzhou for 12,000 lines, in Shanghai for 12,800 lines, in Shenyang for 6,000 lines, and there is a 2-year contract to supply switching facilities for 100,000 lines in the Guangdong province. The AXE exchanges are being built in Sweden and will be delivered over a 3-year period beginning in 1988. China is now using 140,000 AXE lines and has ordered another 280,000. The first wireless telephone network is in use in Qinhuangdao. The Plessey delivery involves digital System X telephone exchanges: 26 switching exchanges with a capacity of 24,000 lines will be supplied as part of a program to modernize the Chinese railways. System X was developed by Plessey and General Electric for the British telephone market. [Excerpt] [Amsterdam COMPUTABLE in Dutch 6 Nov 87 p 17]

25063

CSO: 3698A066

## STUDY OF RELATIONSHIP BETWEEN BREAKING WAVES, ROUGHNESS LENGTH OF SEA SURFACE

40091023 Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 5, Sep 87 pp 477-480

[English abstract of article by Xu Delun [1776 1795 0243] of Shandong College  
of Oceanology, Qingdao]

[Text] Through measurements of breaking waves in a wind-wave tank by a refined method, it has been found that the roughness length of the sea surface,  $z_0$ , is proportional to the jump height of the sea surface,  $J_h$ , at wind velocities above 7.5 m/s, with a proportion coefficient  $\beta = 1/5.5$  for laboratory wind waves. This relationship empirically reveals the physical and geometrical significance of  $z_0$ , i.e.,  $z_0$  can be regarded as the average roughness element of the sea surface as originally defined for rough flow over a solid surface in air dynamics.

The empirical relationship can also be used to rewrite the log-law of the wind profile in a more applicable form, by which one can easily calculate the friction velocity  $u_*$  from  $U_{10}$  and  $J_h$ , whereas the traditional measures for determining  $u_*$ , the wind profile or eddy correlation methods, are difficult to use in the field.

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# NUMERICAL SIMULATION OF TYPHOON SURGE, SURGE ESTIMATE OF HUANGHE RIVER ESTUARY REGION IN BOHAI SEA\*

40091023 Beijing HAIYANG YU HUIHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 5, Sep 87 pp 481-490

[English abstract of article by Ding Wenlan (0002 2429 5695) and Liu Fengshu (0491 7685 2885) of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao]

[Text] The hydrodynamic numerical method is employed in this paper to simulate typhoon surges of three typical tracks in the Bohai Sea. The results coincide with the observations:

1. When the typhoon is in the East China Sea and the Yellow Sea or has crossed the Bohai Sea, the angle between the wind direction of the Jelesnianski wind field and the direction of the geostrophic wind is  $\varphi = 15^\circ$ , while the angle of isobar and concentric circles is  $\lambda = 0$ . When the typhoon has moved into or along the eastern side of the Bohai Sea, the circular wind field effect of the typhoon becomes more obvious and the value of  $\lambda$  increases as the distance increases from the typhoon center.
2. From Tanggu to Shenxiangou, when the traveling speed of the typhoon is in the range of 3 m/s to 9 m/s, the maximum surge increases as the traveling speed increases. However, when  $V_0$  is between 9 m/s and 15 m/s, the maximum surge decreases as the traveling speed increases.
3. The maximum surges occurred for the first time in Laizhou Bay, then the surge crest propagated from north to south along the west coast around the center of the Bohai Sea, appearing to move counterclockwise. This was due to the influence of the Coriolis force.

Based on a numerical simulation, the authors have chosen 10 typhoon tracks, and assume that each typhoon has a traveling speed of 9.8 and 12.3 m/s, respectively. The maximum wind velocities are 15, 20, 25, 30 and 35 m/s, respectively. Therefore, the maximum surges are found at 12 places near the shore of the Huanghe River Delta. The tests show that along the  $I_2$  track the typhoon has the largest effect on the storm surges of the Huanghe River Estuary.

\* Contribution No 1314 from the Institute of Oceanology, Chinese Academy of Sciences.

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## STUDY OF STORM SURGES IN EAST CHINA SEA AND SOUTHERN HUANGHAI SEA\*

40091023 Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 5, Sep 87 pp 498-508

[English abstract of article by Liu Fengshu [0491 7685 2885] of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao]

[Text] Forced waves caused by moving storms are composed of two types of waves ( $f > 0$ ): isolated and edge waves. Whether the storm is moving normal or parallel to the coast, a resurgent isolated wave propagating from north to south can be derived from the storm.

1. Storms traveling normal to the coast induce two forms of edge waves: one accompanies the storm wave and has periods relating to  $\theta$ , while the other accompanies the resurgent isolated waves and has periods that do not relate to  $\theta$ . When  $f > 0$ , the periods decrease slightly with an  $|\theta - \theta_0|$  increase.
2. Storms traveling parallel to the coast induce a form of edge waves which do not vary with  $\theta$ , but are affected by the term  $gaf/V_0$ .

When  $f = 0$ , both types of storm wave induce edge waves with identical periods.

\*Contribution No 1349 from the Institute of Oceanology, Chinese Academy of Sciences.

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SOME NEW PROGRESS IN MARINE CHEMISTRY RESEARCH DURING PAST DECADE IN CHINA

40091023 Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 5, Sep 87 pp 509-514

[English abstract of article by Zhang Zhengbin [1728 2973 2430] of Shandong  
College of Oceanology, Qingdao]

[Text] This paper is a generalization and summary of some new progress in marine chemistry achieved during the past decade. The principal contents consist of the following seven parts:

1. Oceanological survey: The oceanological survey covered the China Sea, the Pacific Ocean and the Antarctic Ocean.
2. The interaction of minor elements and suspended matter in seawater and the theory of interfacial stepwise ion/coordination particle exchange.
3. The effect of organic matter on the liquid-solid interfacial exchange and the rule of left-right shifts of the S-shaped curve.
4. Three new investigation trends of the chemical models of seawater--the structure parameter model, the synthetic chemical model of the inorganic, organic and mixed ligand metal complex and that of the liquid-solid interfacial complex.
5. The complexing capacity and conditional stability constants of the complexation of metals with natural organic ligands in seawater.
6. Marine organic chemistry and marine biochemistry.
7. Four characteristics of recent progress in marine chemistry are presented.

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DISPERSION RELATION FOR NONLINEAR WAVES IN DEVELOPING PROCESS\*

40091022 Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 6, Nov 87 pp 549-562

[English abstract of article by Gu Daifang [7357 0108 2455], et al., of the  
Institute of Oceanology, Chinese Academy of Sciences, Qingdao]

[Text] Correct to the second order in the wave slope, the authors derived the dispersion relation of nonlinear waves in a developing process, proving that there are three main time scales in a developing process of nonlinear waves governed by the coupling mechanism. These three time scales include oscillation, evolution and developing time scales. The authors also proved that, even in the developing process of nonlinear waves, there was no term in the dispersion relation in proportion to the first order of the wave slope. In a stationary case, the authors' results agreed with the discrete form obtained by Weber in 1977. Using Wallops spectrum, the authors' computed results of wave speed were in good agreement with the laboratory measurements made by Ramamonjiarison (1976) involving the energy-containing range.

\* Contribution No 1147 from the Institute of Oceanology, Chinese Academy of Sciences

9717

WINTERTIME LOW FREQUENCY FLUCTUATIONS OF CHINESE COASTAL SEA LEVEL IN HUANGHAI SEA AND EAST CHINA SEA\*

40091022 Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA]  
in Chinese Vol 18 No 6, Nov 87 pp 563-574

[English abstract of article by Zhao Baoren [6392 0202 0088], et al., of the Institute of Oceanology, Chinese Academy of Sciences, Qingdao]

[Text] In this paper, low frequency fluctuations occurring during the winter (1 December 1980 to 31 March 1981) coastal sea level in the Huanghai Sea and East China Sea are analyzed based on the pressure, wind and sea level data at nine coastal stations using the Thompson filter and spectra technique. The following results have been obtained: low frequency fluctuations of sea level are strongly influenced by rapid moving of the cold air across the seas. The principal direction of wind inducing the fluctuation of sea level in the Huanghai Sea and northern East China Sea is approximately NNW-SSE which is almost the same as that of the stretch of the Korean Peninsula and the Huanghai Sea Trough. In the southern East China Sea the principal direction of the wind is approximately E-W, which intersects the coast line of this area by 60°. The main low frequency fluctuations are in the bands centered at about 2, 3 and 5 days. However, fluctuation with a period of 6-7 days also exists in the East China Sea. The amplitudes of the fluctuations are greater in the northern than in the southern part, and greater along the west than the east coast. The fluctuations of sea level forced by wind propagate from north to south, with increasing speed from 18-20 km/hour along the coast of the northern Huanghai Sea to 30-40 km/hour along the coast of the northern East China Sea. In the southern East China Sea the propagating speed of low frequency varies with frequency. For waves with periods of 3 or fewer days, the speed is greater than 40 km/hour, and for waves with periods greater than 6 days, the speed is less than 20 km/hour. The response time scales of sea level to wind also increase from north to south, being 13 hours at Xiaochangshan station and 20 hours at Dajishan station. South toward Dajishan station the response time scales vary with frequency. The spectra of residual sea level show that free waves exist with periods of 2, 3 and 5 days, propagating along the coast from north to south at speeds of 30-60 km/hour, roughly equaling that of kelven waves in these areas.

\*Contribution No 1337 from the Institute of Oceanology, Chinese Academy of Sciences.



# STUDY ON MONOCLONAL ANTIBODIES AGAINST DIPHTHERIA TOXINS

54004141a Beijing WEISHENGWUXUE TONGBAO [MICROBIOLOGY] in Chinese, Vol 13, No 6, Dec 86 pp 263-264

[Article by Li Shouti [2621 1343 1879], Dong Lianzhu [5516 5114 3796], Li Xiulan [2621 0208 5695], Lu Qixiang [6424 2978 4382], Mi Xueping [4717 1331 1627], Xu Xirong [1776 6932 2837], and Yan Taidong [7051 1132 2639], Ministry of Public Health, Pharmaceutical and Biological Appraising Institute, Beijing: "Research on Diphtheria Toxin Monoclonal Antibodies"]

[Text] Ever since 1975 when Kohler and Milsbein demonstrated that bone marrow tumor cells fused with immunized animal spleen cells to form a hybrid cell system that was able to secrete antibodies corresponding to immune antigens, this method has become a rather ideal tool for use in numerous fields.

Diphtheria toxin was one of the earliest discovered bacterial toxins, but up until the early 1970's, the relationship between this toxin's molecular structure and biological activity was still not entirely clear. However, further clarification of this problem will provide impetus for future development of artificially synthesized immunization compounds. It was with this purpose in mind that we began research and development work in 1984 on diphtheria toxin monoclonal antibodies.

## Materials and Methods

1. Preparation of Immunized Spleen Cells: To the diphtheria toxin prepared by the Ministry of Public Health's Beijing Biological Products Research Institute was added an equal amount of anerobic bacillus vaccine to immunize 8 to 12 week old BALB/C mice, two inoculations being made into their peritoneum 2 weeks apart. After 2 weeks, that dose of toxin to which no adjuvant had been added was injected into their veins. Three days following the third immunization, the mice were put to death and their spleens extracted. An 80 mesh copper sieve was used to prepare a cell suspension that was next washed twice in a serum-free MEM culture medium to prepare the cells for use.

2. Cell Culturing and Cell Fusion: Mouse bone marrow tumor cells of the SP 2/0-Ag14 (SP2/0) strain that secreted no IG themselves were imported from the United Kingdom, and a complete MEM culturing medium was used for the culturing of a succeeding generation. SP2/0 cells that had grown well were

selected to make a suspension. Then the mouse spleen cell suspension was mixed in a sedimentation tube at a rate of between 5-8 to 1 SP2/0 cell suspension and centrifuged at 1,000 rpm for 10 minutes. The clear liquid at the top of the tube was then discarded and the material in the bottom of the tube tapped down to mix the cell sediment evenly. It was then placed in a 37 to 38 degrees centigrade water bath and 0.5 ml of a 50 percent solution of polyethelene glycol (PEG MW 2000) was slowly titrated into it, the tube being shaken as titration was done. Titration was completed within 1 minute. After setting for 2 minutes, 15 ml of serum-free MEM was added to halt fusion. After resting for 3 to 5 minutes, it was centrifuged and washed twice in a MEM culture medium. Then the cell suspension was put into 48 ml of HAT culture medium, and separated into culturing dishes, 1 ml being placed on each spot in the dishes. In addition, 1 ml of the mouse cell suspension taken from the mice peritoneums (containing  $5-9 \times 10^5$  cells) was added.

The culturing dishes were placed in a 37 degree centigrade carbon dioxide incubator for culturing. Five days later, microscopic observation of cell growth was begun, and the cells were transferred into a new HAT culture medium. They were then observed every other day. When cell growth covered between one-half to two-thirds of the surface area of the culturing dishes, testing for antibodies got underway. Two weeks after fusion, a change was made to a HT culture medium.

3. Checking for Antibodies: The PHA method was used to check for antibodies.

4. Hybrid Tumor Cell Cloning: The limited dilution method was used to perform three times clonization cultures of the antibody positive hybrid tumor cells. Following expanded propagation of antibody positive cells, they were frozen in liquid nitrogen and three strains namely numbers 2, 23 and 24 extracted from them for continued passing along from one generation to the next, and for examination.

5. Animal Innoculation: Into the peritoneums of each BALA/C mice ranging from 10 to 12 weeks old was injected 0.5 ml of liquid paraffin. One week later  $1-2 \times 10^6$  hybrid tumor cells were injected into the peritoneums of each mouse, and 1 week later, peritoneal fluid was collected from each mouse.

6. Hybrid Tumor Chromosome Analysis: Chromosome segments from the members 2, 23, and 24 strains of hybrid tumor cells that had been passed to the next generation for 24 hours, and from the SP2/0 mouse marrow tumor cells were prepared using the air dry method and stained with 1:50 Giemsa.

7. Immunity Double Diffusion: Immune blood serum containing mouse antibodies taken from sheep, namely IgG<sub>1</sub>, IgG<sub>2a</sub>, IgG<sub>2b</sub>, and IgG<sub>3</sub> was provided by the Shanghai Biological Products Research Institute for experiments in the double diffusion of immunity.

## Results

### (1) Results of Cell Fusion and Testing for Antibodies

The results of three fusion experiments showed a 100 percent formation rate for hybrid tumors. Checking of antibodies using PHA showed the positive rate for hybrid tumors to range between 43 and 50 percent.

### (2) Hybrid Tumor Cell Clone Culturing

Three fusions netted 71 antibody secreting hybrid tumors, which were tested with PHA. Twelve hybrid tumor cells that showed high titers for antibodies were propagated to produce more cells after which they were frozen in liquid nitrogen to prepare a cloning culture. The A<sub>3</sub> positive cells were cloned three times after which the three strains numbers 2, 23 and 24 were tested using PHA. The positive rate for antibodies was found to be 100 percent, and the titer was approximately 1:32. The sub-clone cells were injected into BALB/C mice to produce peritoneal fluid and the PHA method was used to test for antibody positiveness. Maximum titer reached 1:4096. The amount of antibodies found in the peritoneal fluid was 128 times higher than the antibody titer in the culturing solution.

### (3) Results of Neutralization Experiments

Regular procedures were used, results showing three monoclonal antibodies playing no role in the neutralization of toxins.

### (4) Chromosome Analysis and Verification of Antibodies IgG Sub-types

Chromosome segments of the SP2/0 mouse bone marrow tumor cells and of the 2, 23, and 24 hybrid chromosome strains were prepared using the air dry method and counting was done to verify that each of the SP2/0 cells had an average 71 chromosomes, that strain number 2 averaged 105 chromosomes, that strain number 23 averaged 103 chromosomes, that strain number 24 averaged 107 chromosomes, and that the mouse spleen cells contained 40 chromosomes. This shows that the number of chromosomes in the three hybrid chromosome cells, numbers 2, 23, and 24 amounted to the sum of the chromosomes in the SP2/0 mouse bone marrow tumor and the mouse spleen cells. Results from the use of the mouse Anti-IgG in the double diffusion experiments showed that the purified peritoneal fluid from the three strains formed a clear sedimentation line with IgG<sub>1</sub>. (see Figure 1 [not reproduced]).

## Discussion

With the steady development and improvement of monoclonal antibody techniques, the use of monoclonal antibody techniques to analysis all kinds of protein toxins has become increasingly frequent. This article reports the use of diphtheria toxin to prepare monoclonal antibodies against diphtheria toxins. A look at the history of monoclonal antibodies shows that even though it was thought at first that it was more difficult to use soluble antigens than granular antigens to prepare monoclonal antibodies, results have shown soluble

antigens to be quite satisfactory. All that is required is to make the antigens into a smooth emulsion for immunization. When this is done, sufficient spleen cells that have produced antibodies can be obtained, and thus fusion succeeds. In addition, though the indirect hemagglutination method is less sensitive than either Elisa or RIA, the method is simpler and has the advantage of not requiring special equipment. Checking must be done during the early stage of fusion, and although the titer is very low, so long as no antibodies are lost, fairly good results may be obtained. Questions about other properties of antibodies and their correlation to structural parts of toxins await further study.

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9432/7358

## TESTING OF SALMONELLA TYPHI THAT SLOW LACTOSE FERMENTATION

54004141b Beijing WEISHENGWUXUE TONGBAO [MICROBIOLOGY] in Chinese Vol 14,  
No 3, Jun 87 pp 119-122

[Article by Li Hulu [3275 4389] and Liu Haifen [0491 3189 5358], Anshun Prefecture Health and Epidemic Prevention Station, Guizhou Province: "Two Strains of Lactose-Fermenting Salmonella Typhi"]

[Text] Two of the strains of salmonella typhi that our station separated in 1983 were obtained from the blood of patients with a high fever who had been clinically diagnosed as being salmonella sensitive. Apart from slowing the fermentation of 1, 3, and 5 percent solutions of lactose, all other reactions from these two strains of typhi were consistent with those defined for salmonella typhi by Kaufman. A cross agglutination absorption experiment done with standard salmonella typhi showed the antigens of the two to be identical. Though this type of bacteria strain is rarely seen, it may be encountered in the course of daily work; thus, this is a matter meriting attention. If a bacteria strain possesses classic salmonella typhi serological characteristics, though specific individual biochemical reactions may differ, it still cannot be ruled out as being salmonella typhi.

Key Terms: Salmonella typhi and slow lactose fermentation.

In 1983, our station separated from the blood of clinically diagnosed patients with a high fever two strains of salmonella typhi mutants that slowed the fermentation of lactose. Results of evaluation are reported here.

## Materials and Methods

1. Source of Typhi Strains. The two strains of salmonella typhi that slowed fermentation of lactose were obtained from blood cultures of two clinically diagnosed feverish patients. Except for some of the drug sensitive E. coli, which our station separated, the other bacteria strains provided for the experiment including standard salmonella typhi, E. coli shigella flexneri 1b, Arizona [0068 0448 2718 6719] bacteria, and citric acid bacilli were provided by the Ministry of Public Health Pharmaceutical and Biological Appraising Institute.



2. **Salmonella Diagnosed Blood Serums:** This included 18 kinds of serum having an "O" factor, 39 kinds of serum having an "H" factor, and 19 kinds of blood serum containing sub-groups of the dysentery shigella family, all of which were provided by the Ministry of Health's Chengdu Institute for the control of Biological Products (with expiration dates of May 1984 and December 1984).

3. **Culturing Medium:** Conventional methods for preparing the identification culturing medium were used. Blood culturing was done by taking 3 ml of veinous blood from the patients during the acute stage of their illness, and putting it into 50 ml of a 40 percent fresh bile broth culturing medium\* at 37 degrees centigrade to grow bacteria. [Footnote \*. The culturing medium for dish culturing was made up of 60 ml of common beef broth with a pH of 7.8 to which was added 40 ml of fresh pig or ox bile. This was put into 50 ml flasks and sterilized for use.] Every 3 days, a transfer inoculation was made on an Endo plate, and the tenth day showed negative for growth of bacteria.

4. **Supersonic Crusher.** This was a product of the Shanghai Supersonic Instrument Factory with the name and specifications of CSF-1A, 0-500mA, 220V. Supersonic crushing of the bacteria was done at 350mA for 1/2 hour.

5. **Drug Sensitive Paper Strips:** These were provided by the Shanghai Reagent Shop.

6. **Plasmid Shift Experiment.** Done using the method of Weng Zhengyi [5040 2973 0001] et al.

## Results

### (1) Biochemical Characteristics

Only the lengths of time for lactose fermentation by the two patients' blood cultures varied. Except for the 1, 3, and 5 percent lactose fermentation done on the fourth and sixth days, biochemical reactions were otherwise consistent with Kaufman's definitions for salmonella family. Both positive and negative biochemical reactions were the result of 13 days of observation. Details of these physiological reactions are shown in Table 1.

Table 1. Biochemical Reactions of the Two Strains of Typhoid Bacilli That Showed Slow Lactose Fermentation

Keshi [0344 3044] Disaccharide Group Results After 24 hours															
Lactose	Glucose	Urea	Kinetics	Hydrogen	Glucose	Maltose	Mannitol	Arabinose	Xylose	Trehalose	Glycerol	Dulcitol	Cane sugar	Phenylalanine	Adonitol
-	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+
Lactose				Galactose	Salicylate	Inositol	Glycerol	Pyruvate	Sulfonamide	Ascorbic acid	Indigo	V.P. reaction	Citrate	Nitrate reduction	Tartrate
1%	3%	5%													
+++	+++	+++		-	-	-	-	-	-	+	-	-	-	+	-

## (2) Antigen Analysis

1. Glass Slide Agglutination Reaction: The agglutination strength of blood serums containing the two bacteria strains with the typhoid "O" factor are polyvalences A-F (+++), O<sub>9</sub> (++) Vi(++), the "H" factor blood serum d(++); when mixed with the following salmonella "O" factor blood serums 1,2,4,5,7,8,10,11, 14,15,19,10,27,34,46 and 3.19, and with the dysentery shigella bacteria; the shigella bacteria A group polyvalent. the Baoshi [7637 3044] polyvalent 1-5, and the shigella sonnei bacteria-diagnosed serums, did not agglutinate except in the case of shigella flexneri bacteria B group polyvalent in which an extremely slight agglutination occurred. The saline solution control was negative.
2. Fernand Widel Reaction: Blood was taken from the patients on the 14th and 16th days of their illness to test the Fernand Widel reaction. Both the "O" and the "H" agglutination titer reached more than 1:640(++).
3. Test Tube Agglutination Test: Test tube agglutination testing was done on the "O" blood serum containing the two bacteria strains and the typhoid with a primary titer of 5120, and on the "H" with a primary titer of 3200. Results showed the titer of both the "O" and the "H" to be more than 2560.
4. Testing for Vi Antigens: After standard salmonella typhi O<sub>901</sub> and H<sub>901</sub> were used to absorb two rabbit blood serums immunized against the two bacteria strains, a corresponding amount of the two bacteria strain suspension and of the typhoid bacteria suspension were used in test tube agglutination tests. Titer reached 1:640, demonstrating that the two strains of bacteria had Vi antigens.
5. Cross Agglutination Test: When immunized serum containing the two bacteria strains taken from rabbits and standard salmonella typhi (Number 50096) were used in a test tube agglutination test in which the titer reached 1:1280, but the agglutination titer with E. coli (bacteria number 44130) reached 1:200-400; with shigella flexneri 1b (bacteria number 51302), the agglutination titer reached 1:200, and with the Arizona bacteria (bacteria number 48,302), and the citric acid bacillus (bacteria number 47001), there were no marked cross reactions (all less than 1:10). Saline solution controls were negative.
6. Cross Absorption Test (See Table 2). Two strains of lactose-fermenting salmonella typhi mycelia antigens, "O", and flagellar antigens, "d", absorbed, in the conventional way, immunized rabbit blood serum containing standard salmonella typhi mycelia antigens, "O" and flagellar antigens, "d", as well as standard salmonella typhi and corresponding immunized rabbit blood serum to begin cross absorption tests. Results showed a mutual absorption between the two strains of lactose-fermenting salmonella typhi and the standard salmonella typhi; thus the antigens in both were identical.

Table 2. Results of Cross Absorption Tests on Two Strains of Lactose-Fermenting Salmonella Typhi and Standard Salmonella Typhi

Test Strains	Test Tube Agglutination Titers (Reciprocals) before and after absorption			
	Standard Typhi Immunized Serum		Lactose-fermenting Positive No I Typhi Immunized Serum	
			Lactose-fermenting Positive No II Typhi Immunized Serum	
Lactose Positive No I Typhi	Before	0	1024	2560
	Absorption	d	640	2560
	After	0	< 10	< 10
	Absorption	d	< 10	< 10
Lactose Positive No II Typhi	Before	0	1024	2560
	Absorption	d	640	2560
	After	0	< 10	< 10
	Absorption	d	< 10	< 10
Standard Salmo- nella Typhi	Before	0	1024	2560
	Absorption	d	640	2560
	After	0	< 10	< 10
	Absorption	d	< 10	< 10

Note: "0" is mycelium immunized rabbit serum; "d" is bacteria strain flagellar immunized rabbit serum.

### (3) Tests For Drug Tolerance and For Plasmid Shift

1. Drug Tolerance Test: The paper strip method was used to test the drug tolerance of the two lactose-fermenting bacteria strains against kanamycin, gentamycin, terramycin, tetracycline, ampicillin, chloromycetin, a mixture of neomycin, nogalamycin, and gelatin, berberine, furacillin, and furaxone. Results showed the two bacteria strains as being drug tolerant for berberine, terramycin, and furaxone, the bacteria inhibiting circles being smaller than 10 mm. They were sensitive to the other drugs in varying degrees.

2. Testing of Plasmid Shift Drug Tolerance Factor (R): The two bacteria strains that were tolerant of the berberine, terramycin, and furaxone served as donor bacteria in this test, and E. coli (tagged 8309 in the laboratory) that were centrifuged from human feces and showed sensitivity to the aforementioned drugs served as recipient bacteria. The two were inoculated into a tube containing 2 ml of beef broth and cultured at 37 degrees centigrade for 6 hours. Then 0.1 ml of the donor bacteria culturing fluid was inoculated into the recipient bacteria solution, stirred till it was evenly distributed, and then cultured at 37 degrees centigrade for 72 hours. Then a flat dish was used for separating the bacteria strains to perform the paper strip drug sensitivity test. Results showed the two strains of donor bacteria to have become sensitive to the aforementioned drugs, and the recipient bacteria to have become tolerant of the aforementioned drugs.

3. Associated Plasmid Shift Experiment: Lactose positive salmonella typhi (Lac<sup>+</sup>) cultured in beef broth for 6 hours were crushed with a supersonic wave and processed in a 0.3 percent solution of formaldehyde (so that there were



no live bacteria in the live bacteria experiment). These bacteria served as donor bacteria, and the unprocessed lactose negative standard salmonella typhi (Lac<sup>-</sup>) cultured in broth for 6 hours for use as recipient bacteria to perform the associated plasma shift experiment. Each of the inoculating loops of the above Lac positive broth was inoculated into 2 ml of Lac negative broth culture and cultured at 37 degrees C for 72 hours. Then the recipient bacteria were centrifuged out. As a result, some of the bacteria strains became Lac positive live bacteria, but this phenomenon was not found in the bacteria that had been crushed by supersonic waves.

#### (4) Animal Experiment

An inoculation loop was taken from the experimental bacteria 6 hour broth culture and inoculated into one side of the cornea of two guinea pigs. The opposite side of the cornea received saline solution as a control. Each was observed once each 24 and 48 hours, no inflammation being noted. The same method was used on another guinea pig using dysentery bacillus as a control. Observation after 24 hours showed inflammation, and after 48 hours the inflammation was pronounced. A standard typhoid bacillus was used as a control, with no resultant inflammation.

#### Discussion

There have been few reports in either Chinese or foreign journals since Twort reported the lactose-fermenting lactose salmonella typhi mutations. Of the 201 strains of salmonella typhi that our station isolated in 1983, except for two strains used in 3 and 5 percent lactose tests that slowed fermentation, all other biochemical reactions were consistent with the Kaufman salmonella bacteria definition. Reportedly, higher lactose concentration hastened the lactose fermentation reaction. It is only the beta galactosidases among these bacilli that slow lactose fermentation. There are no penetrating enzymes, for which reason, it is the opportunities of mechanical collisions between lactose molecules and beta galactosidases giving the ability to slow lactose fermentation. The ability of these bacteria to slow lactose fermentation may possibly be the result of associated plasmid shift among bacteria strains in the intestines. Whether this property is consistent awaits further observation.

Results from the two strains of lactose-fermenting salmonella typhi that we isolated show that even those such bacterial strains are rarely seen, they may be encountered in actual daily life; thus they merit attention. If a bacterial strain possesses typical salmonella serological characteristics, even though its specific individual biochemical reactions may differ, it cannot be ruled out as being a salmonella bacteria.

The drug tolerance "R" factor shift experiment showed that this strain of bacteria contains the R factor. The R factor occurs generally in all families of bacteria in the intestines and may shift back and forth. This is of definite significance clinically and epidemiologically.

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This article was examined and approved under the direction of Dr. Chen Ce [7115 4595] of the Guizhou Provincial Health and Epidemic Prevention Station, and the two bacterial strains were approved by Provincial Health and Epidemic Prevention Station, for which appreciation is hereby expressed.

9432/7358

## CONCENTRATION, PURIFICATION OF CRUDE HUMAN INTERFERON

40081007a Beijing SHENGWUHUAXUE YU SHENGWULI JINGZHAN [PROGRESS IN BIOCHEMISTRY AND BIOPHYSICS] in Chinese No 3, Jun 87 pp 75-79

[Article by Li Chengwen [2621 2052 2429], Shao Junshi [6730 6511 4258], Wu Benzhan [0702 2609 0278], and Li Hongyi [2621 4767 0001], Institute of Microbiology and Epidemiology, Academy of Military Medical Sciences: "Concentration and Purification of Crude Human Beta Interferon"]

[Text] Abstract: This article reports the use of Millipore super filter membranes to concentrate crude human beta interferon. Filtering is fast, the active recovery rate is high, and a certain amount of purification is also done by these membranes. A single blue dextran sepharose column chromatography using sepharose CL-6B following concentration of the interferon sample produces a 2,800 fold purification, and super activation may reach international clinical standards of more than  $10^6$   $\mu$ /mg of protein.

Human beta interferon is an unstable small molecule glycoprotein with broad spectrum anti-viral properties and extremely high biological potency (a single mg of protein has a potency of at least  $10^{10}$ . [1] Most of the crude human beta interferon produced today is of low activity and contains a large number of protein impurities. It requires concentration and purification to make it suitable for clinical use.

In recent years, there have been quite a few references from abroad pertaining to the concentration and purification of crude human beta interferon, and though some units inside China have also been pursuing such research, nothing has been published as yet. We used low temperature high speed centrifuging and super filtering concentration techniques, which are not only fast and have a high active recovery rate, but also eliminate some unwanted protein impurities. The Blue Dextran Sepharose CL-6B--agrose gel chromatographic method of Knight et al [2] was consulted for the purification of crude human beta interferon following concentration, with some changes being made in operating conditions. The product obtained was more than 2,800 times as pure in terms of specific immuno-competency, its quality reaching international clinical standards (1 mg of protein containing  $10^6$  units of interferon immuno-competency), and the interferon active recovery rate was 63.8 percent. The methods and results of the experiment are reported below.

Frozen crude interferon

↓

Water bath thawing

↓

Centrifuging to get rid of granules (2°C at 10,000 rpm for 20 minutes)

↓

↓  
Discard sediment

(Inactive protein  
impurities)

↓  
Clear stop liquid

↓  
Super filtering concentration 0.025  $\mu\text{m}$ ,  
3 kg/ $\text{N}_2/\text{cm}^2$ , 20°C

Discard filtrate

↓

Put concentrate on membrane

↓

BDS chromatography

0.02 M pH 7.2 PB

↓

First protein peak

PB + 50% ethylene glycol + 1 M NaCl

↓

Second protein peak

↓

Interferon Immuno-Competency peak

↓

Product processing and analysis

## Results of Experiment

### 1. Concentration of Crude Human Beta Interferon

In the experiment, an anti-BSA non-specific affinity adsorbent was used to adsorb, and both ammonium sulfate chromatography of different degrees of saturation and super filtering membranes of different porosity were used to effect concentration. The results show that use of the super filter for concentration is not only simple and fast, but effects greater purification at the same time. On the basis of concentration results achieved by using filtering membranes of different porosities, the filtering membranes with a porosity of 0.025  $\mu\text{m}$  were found to produce best results. The average speed of flow using such a filter was between 60 and 100 ml per hour, and the interferon recovery rate averaged 87.73 percent. Table 1 and Table 2 show results.

In addition, in the process of concentrating more than 10,000 ml of crude interferon, when ox blood plasma albumin and hog stomach protease were used as simulation samples, it was observed that the speed of filtration was directly proportional to the amount of pressure used in super filtration, but was inversely proportional to the protein cut-off rate. The higher the concentration of protein in the sample, the lower the speed of filtration, and the cut-off rate for the protein on the membrane became high. On the basis of the performance of the super filtering membrane and the characteristics of the super

## Methods and Procedures

### 1. Superfiltering to Concentrate Crude Human B Interferon

The crude human beta interferon sample was taken from a low temperature refrigerator and placed in a warm water bath to thaw. It was then centrifuged at 10,000 rpm at a temperature of 2°C for 20 minutes to remove cell fragments and protein that had spoiled. Next it was filtered through a super filtering membrane with 0.025  $\mu$ m pores using 3 kg  $N_2/cm^2$  pressure to achieve an approximately 10 fold concentration in a cold box at 2°C.

### 2. BDS Chromatographic Purification of Human Beta Interferon

To 10 grams of dry BDS powder, sufficient PB was used to swell the volume to approximately 40 ml, which was put into two columns, one of which measured 1.5 x 12.5 cm and the other 1.5 x 9.5 cm. Then 0.02 m of PB at a pH of 7.2 was used for full balancing. The PB-balanced concentrated crude sample was then placed in the columns, the speed of flow being between 0.2 and 0.5 ml per minute. Next, the columns were stored at 4°C for 2 hours. The aforementioned PB was first used to wash off the first protein peak (protein impurities). After the OD<sub>280nm</sub> ultraviolet monitoring of the eluted peak reached the base line, the same PB containing 50 percent ethylene glycol (EG) and 1 m of NaCl was used to wash down the second protein impurity peak. The tail end of that peak contained interferon of low immuno-competency. At this time, the interferon began to be collected in separated tubes at a rate of one tube every 5 minutes for a total of approximately 30 tubes. If the amount of sample was to be approximately 50 ml, small columns could be used. If it was going to be approximately 80 ml, ( $10^7$  units) large columns would have to be used to collect approximately 50 tubes of interferon. This entire operation was carried out at below 4°C.

### 3. Measurement and Biochemical Analysis of Interferon Immuno-Competency

The microplate dyeing method was used to determine competency.[3] Before and after purification, polyacrylamide gel was used to analyze the protein in the interferon[4]; SDS-PAGE[5] was used to determine the molecular weight of the protein; column shaped focused electrophoresis[6] was used to check isoelectric points and to analyze one-way immunity diffusion antigen components, and the ultraviolet absorption method was used to determine the concentration of the protein.[7]

### 4. Processing and Preservation of Purified Human Beta Interferon

The purified human beta interferon sample had a fairly high biological immuno-competency, but protein viscosity was low since it contained approximately 40 percent ethylene glycol, which had to be filtered out by using super filtering methods. Then 3 mg/ml of human blood plasma protein was added to it as a preservative, and it was stored at -70°C.

The foregoing operational process may be capsulized as follows:

## Materials and Reagents

The crude human beta interferon was provided by the institute's interferon unit, and some batches of interferon were more active than others. For specifics, please see Table 1 and Table 2. The rabbit-anti-human blood serum and the rabbit-anti-BSA blood serum were prepared by the unit in 1984. The super filtering membrane was a product of the Millipore Company in the United States and was supplied in three different porosities, namely 0.025  $\mu$ m, 0.05  $\mu$ m, and 0.1  $\mu$ m. The super filtering device was manufactured by the Academy's factory. The effective filtering membrane area was 39 cubic centimeters. The BDS was a product of Pharmacia Fine Chemicals.

Table 1. Comparison of the Use of Different Methods For Concentrating Human Beta Interferon

Method	Conditions	Recovery Rate (%)	Remarks
Ammonium sulfate analysis	Saturation 20%	20.1	Slow sulfate elution
	Saturation 45%, 60%	25.4	
	Saturation 60%, 80%	44.5	
Super filtering method	Pore diameter 0.1 $\mu$ m	32.0	Large pore diameter Holds back most of the interferon
	0.5 $\mu$ m	54.0	
	0.025 $\mu$ m	95.1	
Ammonium sulfate-super filtering	20%, 0.025 $\mu$ m	24.3	Loss of sulfate during chromatography
	25%, 0.025 $\mu$ m	58.5	

Table 2. Results of Super Filtration to Concentrate Human Beta Interferon

Batch Number	Before Concentration			After Concentration				
	Volume (ml)	Potency ( $\mu$ /ml)	Total potency ( $\mu$ )	Volume (ml)	Potency ( $\mu$ /ml)	Total potency ( $\mu$ )	Purification Multiple	Recovery Rate (%)
1	260	197	$5.1 \times 10^4$	32.0	1540	$4.9 \times 10^4$	3.5	96.1
2	72	8,150	$5.9 \times 10^4$	12.0	46652	$5.6 \times 10^4$	3.3	94.9
3	86	19,767	$1.7 \times 10^5$	22.0	50,000	$1.1 \times 10^5$	10.0	64.7
4	1050	5,047	$5.3 \times 10^4$	110.0	43,636	$4.8 \times 10^4$	1.3	90.6
5	1000	2500	$2.5 \times 10^4$	86.5	25,434	$2.2 \times 10^4$	2.3	88.0
6	2000	3150	$6.3 \times 10^4$	202.0	26712	$5.8 \times 10^4$	2.1	92.1
Total	4468			464.5				Average 87.73 %



filtering membrane device, a nitrogen pressure of 3 kg/cm<sup>2</sup> was selected. In general, results were better when the concentration in the sample was approximately 10 times. See Figures 1 through 4 for information about the effect on the speed of filtration and the protein cut-off rate of differences in pressure and the degree of protein concentration.

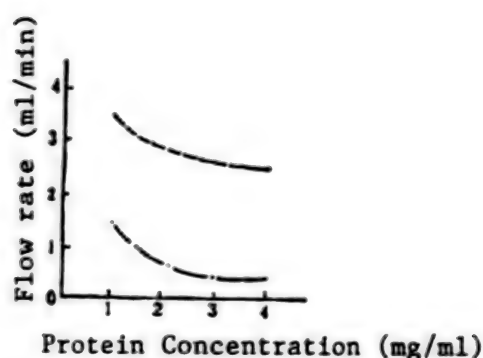


Fig. 1. Effects of Protein Concentration on Speed of Filtration

----- Ox blood plasma albumin  
-.-.- Hog stomach protease

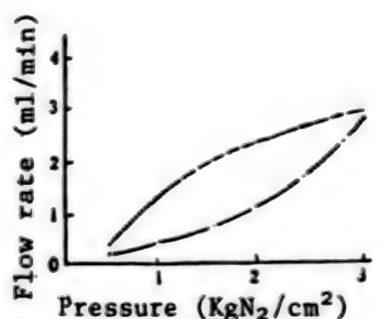


Fig. 2. Effects of Pressure on Speed of Filtration

----- Ox blood plasma albumin  
-.-.- Hog stomach protease

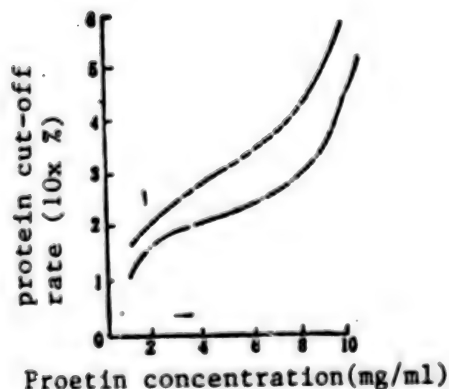


Fig. 3. Relation between protein concentration and cut-off rate

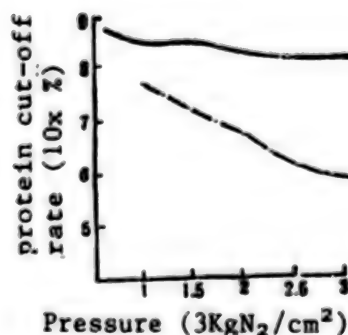


Fig. 4. Effect of pressure on protein cut-off rate

## 2. Human Beta Interferon Purification Results

Table 3 and Figure 5 show that use of BDS chromatography to purify crude human beta interferon is convenient, fast, and has a high purification multiple. Purification experiments were done on four batches, the maximum specific competency purification multiple reaching more than 2,800, the interferon specific competency averaging  $10^6$   $\mu$ /mg of protein, and the interferon active recovery rate averaging 63.8 percent. The interferon energy peak was located

behind the end of the second impure protein peak, so usually it was possible to collect between 30 to 50 tubes of interferon sample when the protein adsorption peak had dropped to the base line.

Table 3. Results of BDS Chromatography Purification of Human Beta-Interferon

Batch Number	Crude HuIFN- $\beta$			Purified HuIFN- $\beta$				
	Volume (ml)	Immuno-competency ( $\mu$ /ml)	Specific activity ( $\mu$ /mg, protein)	Volume (ml)	Immuno-competency ( $\mu$ /ml)	Specific activity ( $\mu$ /mg, protein)	Purification Multiple	Recovery Rate (%)
1.	3800	3,493	1431.5	41	14285	$1.4 \times 10^6$	957.9	44.12
2.	1000	4,768	1978.4	37	108426	$5.7 \times 10^6$	2881.1	84.13
3.	12.5	24,776	8461.2	11.5	25074	$2.5 \times 10^6$	295.5	93.1
4.	1030	10,000	5617.8	14.9	100000	$1.0 \times 10^7$	1780.1	14.5
				23.2	85000	$5.1 \times 10^6$	907.8	19.4

\*33.9 percent. Recovery rate and specific activity was figured only for samples having more than  $10^6 \mu$ /mg; Samples having less than  $10^6 \mu$ /mg of protein were not figured in.

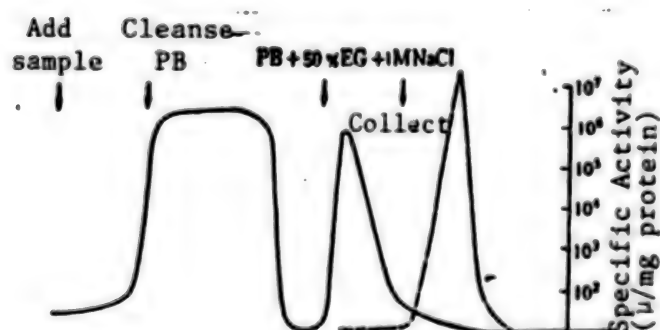


Figure 5. BDS Chromatography of Human Beta-Interferon

———— Protein Absorption Peak  
 ----- Interferon Potency Peak

### 3. Analysis of Human Beta Interferon Before and After Purification

In addition to measuring the amount of ultraviolet absorption of the total protein concentration, PAGE and SDS-PAGE, isoelectric focusing electrophoresis



and one-way immunity diffusion BSA quantification was done for all samples of crude human beta interferon that had been concentrated and purified. The electrophoresis results show a marked increase in purity of the purified samples. Before purification, the BSA impure protein was at about 1 mg/ml; but after purification, it was only between 10 and 50  $\mu$ g/ml. Measurements were also made of the interferon immuno-competency in the SDS-PAGE gel columns. The molecular weight in the gel was about 20,000 and it had a fairly high interferon immuno-competency. This result accorded with the report by Knight.

## Discussion

In the purification of crude human beta interferon, blue dextran sepharose-agarose gel chromatography is now generally acknowledged to be a simple and fairly effective method. In 1980, Knight[2] first used this method to purify human beta interferon 500 fold, and in the following year, he used one large and one small BDS column to purify human beta interferon 2,941 fold, its specific competency reaching  $5 \times 10^8$   $\mu$ /mg of protein.[8] In the same year, Stanley et al[9] reported a 1,000 fold purification of human beta interferon, with a specific competency of  $1 \times 10^7$   $\mu$ /mg of protein. Using the BDS method, Kenny et al[10] also produced a  $1.1 \times 10^8$   $\mu$ /mg of protein product. We improved the method that Knight used in 1981 by linking it to super filtration concentration and chromatographic conditions, also achieving a 2,800-fold purification of human beta interferon, and a specific competency reaching  $1 \times 10^7$   $\mu$ /mg of protein.

Despite the reports in recent years of the measurement of the biological immuno-competency of human beta interferon by using monoclonal antibodies to measure radioactivity immunity,[11] this has been applied in only a few laboratories. Most Chinese and foreign units engaged in human beta interferon research and production use the cell pathology inhibitor dyeing method. Since that method is affected by various factors including cell growth, the strength of attacks on virus toxicity, and culturing conditions, consistency of measurement results is poor, and fluctuations are fairly large. Sometimes, recovery rates show up as being larger than 100 percent. Examples included recovery rates of 106 and 167 percent when Kenny et al used the BDS chromatographic method for purifying human beta interferon, and when the Shangyhai Biological Products Research Institute purified alpha interferon, it also showed a recovery rate greater than 100 percent. When we used super filtration to concentrate crude human beta interferon, on four occasions test results showed interferon immuno-competency recovery rates greater than 100 percent.

Human beta interferon is an extremely unstable small molecule glycoprotein that is especially prone to lose potency during purification unless 50 percent ethylene glycol is used during chromatography and unless 3 mg/ml of human albumin are added to the purified product as a preservative. Insofar as possible, the entire operating process has to be done at low temperature and speedily, and the destructive action of physical and chemical factors has to be reduced. In addition, it was noted in the experiment that the immuno-competency of the crude human beta interferon, and its impure protein content is directly by the specific competency and size of the recovery rate following purification.

Consequently, it is best to use a product of fairly high competency, but low overall protein viscosity, or else to purify separately sample in which there is a great disparity in the amount of biological immuno-competency.

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(Article received on 29 September 1986).

9432/7358

## TECHNIQUE FOR PURIFYING CERTAIN MONOCLONAL ANTIBODIES

40081007b Beijing SHENGWUHUAXUE YU SHENGWULI JINGZHAN [PROGRESS IN BIOCHEMISTRY AND BIOPHYSICS] in Chinese No 3, Jun 87 pp 79-80, 25

[Article by Ren Lie [0117 0399], Shen Jingjing [3088 2533 2533, Chen Xiaosui [7115 2556 4482], and Lu Zhi [0719 2784], Central Experimental Department, Naval General Medical School: "Single-Step Purification of Monoclonal Antibody (McAb) Against Insulin With FPLC"]

[Text] Abstract: This article reports the method for using the fast protein liquid phase chromatograph produced by the Pharmacia Company of Sweden, and a strongly negative ion exchange pre-assembled column (Mono Q) in the single step purification of insulin monoclonal antibodies. Results show this method to be fast and convenient, and to produce good results in duplication and separation. Immuno-competency of the monoclonal antibodies following purification is approximately 94 percent.

Since monoclonal antibodies (McAb) derive primarily from the supernate of cell cultures or from animal peritoneal fluid, to a certain extent, they are mixed with non-antibody proteins and fatty substances, so they must be purified in order to eliminate from experiments all non-specific bonds and interferences. We used the fast protein liquid phase chromatograph (FPLC, for short) produced by the Pharmacia Company in Sweden to set up a single-step method for purifying insulin (McAb) that was fast, convenient, and produced good results in duplication and separation.

#### 1. Materials and Methods

##### 1. Materials

- a) Antibodies: Insulin McAb of the IgG<sub>1</sub> sub-group is a strain made by our own laboratory
- b) Trisamine (Tris): Content no less than 98.5 percent. Fluka. Imported in separate packages
- c) Ampholine: pH 3.5 - 10 (Swedish LKB Company)

d) Multiphore-2117 Isoelectric Focusing Electrophoresis Device: Same as next above

e) LCC-500 FPLC: Swedish Pharmacia Company

6) Mono Q Column: Strongly Negative Ion Exchange Pre-assembled Column (0.5 x 10 cm). Same as next above

## 2. Method

a. Purification of Insulin McAb. Use centrifuged hybridoma peritoneal fluid at 4°C; remove the supernate and dilute 1:1; then filter through a Millipore membrane (porosity of 0.22  $\mu$ m), and then use a Mono Q pre-assembled column, [1,2] placing a single 500  $\mu$ l sample in it, and use the salt line gradient method (Solution A consisting of 50 mmol/L Tris-HCl buffering solution at a pH of 8.0; solution B consisting of solution A plus 0.35 mol/L NaCl, at a pH of 8.0) for elution, the speed of flow of the sample being 1 ml per minute at a pump pressure of approximately 2MPa for a total elution volume of 20 ml. Use a single channel 280 nm ultraviolet assayer (10 mm light channel high resolution rate flow battery) with an assay selection of AU = 0.5. Use a REC-482 dual track recorder for recording, its low speed being 1 cm per min.

b. Electrophoresis Evaluation. Use the flat plate isoelectric acrylamide gel (IEF-PAGE) electrophoresis method to evaluate purity. [3] Following column chromatography, the sample should undergo dialysis to remove the salts. The gel concentration should be 5 percent; it should be 0.5 mm thick; the volume of the specimen should be 30  $\mu$ l, the installed amperage should be 30 mA; voltage should be 1,500 V; power should be 25 watts; and electrophoresis time should be 1.5 hours. Kaomasianglan R250 [5072 7456 2448 0081 5663] dyeing and decoloring.

c. Measuring potency. Use the radioactive immunity balanced saturation analysis method to measure the immuno-competency of the insulin McAb after purification.

## 2. Results

a. Column Chromatograph: After the insulin McAb has been purified, it separates out into six major peaks as shown in Figure 1.

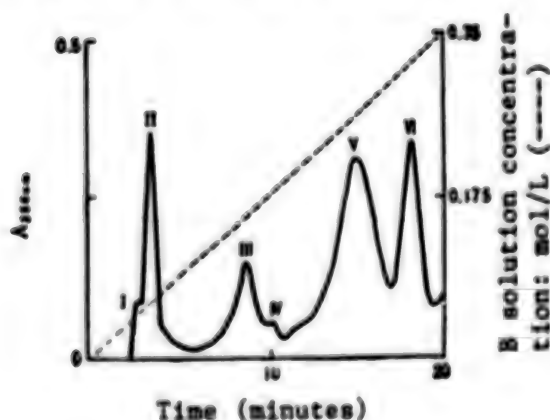


Fig. 1. First Mono Q Column Chromatograph Spectrum

----: B solution concentration: (mol/L)

2. Immuno-competency of Insulin McAb: Measurements for the immuno-competency of antibodies at the separate collection peaks shown above are shown in Table 1. Peak V is for purified insulin McAb, 500  $\mu$ l of which was put into a Mono Q column and eluted under the conditions described in Figure 1 to produce a single peak, the time in the column being the same as for peak V.

Table 1. Immuno-competency of Monoclonal Antibodies Following Purification

	Before Purification			After Purification		
Vial Number	0	1	2	3	4	5
cpm(x)	9412	2497	2518	2884	3109	8918
Immuno-competency (%)	100					94.2

Note: The non-specific tube count for cpm is 2299.

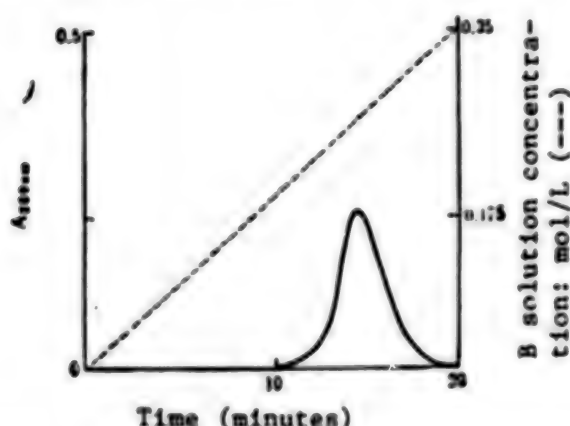


Figure 2. Second Mono Q Column Chromatograph

-----: B solution concentration (mol/L)

3. IEF-PAGE Evaluation of Purity: The original peritoneal fluid exhibited numerous bands (See Figure 3,I), but following single-step chromatography in a Mono Q column, it exhibited only one band. (See Figure 3, II [not reproduced])

### 3. Discussion

Classic polyclonal antibody methods are frequently used in the separation and purification of McAb, such as salt chromatography and the ion exchange column chromatographic two-stage method or the affinity chromatographic method.[5,6] We believe that the steps required for purification are unnecessarily complicated for the first method, and that it takes a lot of time. Because McAb is directed at monoclonal antigenic determinants, minute changes in the structure of spaces between molecules can affect their immuno-competency, and the longer

the extraction time, the greater the loss of competency. Samples are readily diluted, and frequently concentration becomes necessary following extraction. Though the affinity chromatography method has certain specific strengths; nevertheless, purified McAb cannot be readily obtained when this method is used on some antigens. We obtained rather satisfactory results by using the FPLC system for the single-step purification of McAb. (See Figure 1)

The soul of the FPLC system lies in fine tuning; it is completely responsive to commands set by the operator, and results of experiments can be readily duplicated. Immuno-competency tests showed a fairly small loss of antibody competency as a result of the McAb having gone through the Mono Q column, and as being substantially identical with results reported in the references, i.e., protein competency was maintained at between 90 and 100 percent following separation.

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(Article received on 28 October 1986)

9432/7358



EVALUATION OF DIAGNOSTIC SIGNIFICANCE OF ANTI-HBc IgM IN SUBCLINICAL HEPATITIS B INFECTION

40091024 Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 12 No 4, Aug 87 pp 269-272

[English abstract of article by Xu Dezong [1776 1795 1813], et al., of the Department of Epidemiology, Fourth Military Medical College, Xi'an]

[Text] The results of detection for anti-HBc IgM in six acute hepatitis B cases and a group of individuals with subclinical infection in an epidemic of HB are reported in this paper. The authors followed up five children with subclinical HB infection for 6-7 months and found that the anti-HBc IgM in their sera became negative or declined, while anti-HBs became positive. The results show that the marker of anti-HBc IgM can be used as an indicator of recent subclinical HB infection. These results are valuable in epidemiological surveys of HB in the general population. The geometric mean values (GMV) of S/N of anti-HBc IgM during the "window period" and the period of seroconversion to anti-HBs in subclinical infection are 3.9 and 1.9, respectively, lower than those during clinical infection (6.9 and 7.4, respectively). In addition, the duration was shorter. The phenomenon is worthy of further study. During the early convalescence, i.e., the period of seroconversion to anti-HBs in patients with acute hepatitis B, the GMV of S/N of anti-HBc IgM is high, up to 7.4, which indicates that they might also be infectious.

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CLINICAL SIGNIFICANCE OF IgA ANTI-HBc IN VIRAL HEPATITIS B

40091024 Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese Vol 12 No 5, Oct 87 pp 335-337

[English abstract of article by Liu Huiyu [0491 6540 1342], et al., of the 302nd Hospital, PLA]

[Text] The authors have developed an antibody-captured sandwich-type enzyme linked immunosorbent assay (ELISA) with monoclonal anti-IgA/a (human) and monoclonal anti-HBc, and have determined immunoglobulin A against hepatitis B core antigen (IgA anti-HBc) in sera of 179 cases of various types of HBV infection. IgA anti-HBc in the patients with acute hepatitis B (14 cases) and severe hepatitis (7 cases) was all positive, while in the patients with chronic active hepatitis, cirrhosis, chronic persistent hepatitis and symptomatic carriers the positive rates were 94 percent (47/50 cases), 83.3 percent (10/12 cases), 56.5 percent (26/46 cases) and 4 percent (2/50 cases) respectively. The authors' observations suggest that IgA anti-HBc may reflect hepatic damage in patients with HBV infection. Its detection may be valuable in the diagnosis and prognosis of HBV infection. In addition, the activity of IgA anti-HBc in chronic hepatitis B is related to HBeAg.

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DETECTION OF HBcAg WITH NITROCELLULOSE-ENZYME LINKED IMMUNOSORBENT ASSAY  
(NC-ELISA)

40091024 Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S  
LIBERATION ARMY] in Chinese Vol 12 No 5, Oct 87 pp 328-330

[English abstract of article by Li Fangqiu [2621 5364 4428], et al., of the  
Department of Clinical Immunology, General Hospital of Nanjing Command, PLA]

[Text] A new ELISA method for the detection of HBcAg in serum has been established with nitrocellulose as the solid carrier. The HBV-anti-HBs complex formed with patient's serum and horse anti-HBs was applied to the nitrocellulose membrane under a vacuum, using a special apparatus, and then was fixed on the filter at room temperature overnight. HBcAg was determined with HRP-anti-HBc after treatment with 3 mol/L NaCNS. In comparison with the methods for serum HBcAg previously described, this technique is simple to perform. Its sensitivity and specificity are satisfactory for clinical purposes. The results from the study of clinical specimens indicate that HBcAg is closely correlative to HBsAg, anti-HBc and HBV-PHSAR.

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COMPARATIVE STUDY ON APPLICATION OF PLASMID PROFILE ANALYSIS, PHAGE-TYPING, ANTIMICROBIAL SUSCEPTIBILITY TESTING TO EPIDEMIOLOGICAL INVESTIGATION OF TYPHOID

40091025 Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese Vol 8 No 5, Oct 87 pp 272-275

[English abstract of article by Xiao Qianlin [5135 7816 2651], et al., of Anshun District Sanitary and Epidemic Station, Guizhou Province]

[Text] Plasmid profile analysis, phage-typing and antimicrobial susceptibility patterns have been used to analyze the strains of *S. typhoid* isolated during the epidemic of October 1985 and during the spring-summer period of 1986 in Anshun Prefecture, Guizhou Province. In combination with the epidemiological analysis, it is shown that plasmic profile analysis and phage-typing prove to be useful methods for detecting the characteristics of prevailing strains. In terms of finding the coincidence with the epidemiological data and ease of performance, plasmid profile was found to be better than phage-typing. However, the antimicrobial susceptibility pattern gave unsatisfactory results.

According to the results of plasmid profile analysis, it is clear that the strain clone with 100Md plasmic was the main causative agent for the epidemic. Furthermore, strains with the phage-type M1 were found to be the principal pathogens for the epidemic on the basis of phage-typing. The same strains caused sporadic typhoid in 1986, but it was also found that some other strain clones caused isolated cases.

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OBSERVATION OF EFFECT OF PURIFIED SCHICK TOXIN IN FIELD USE, COMPARISON OF THREE METHODS FOR DETECTION ON DIPHTHERIA ANTITOXIN LEVEL

40091025 Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese Vol 8 No 5, Oct 87 pp 291-293

[English abstract of article by Xiao Xiling [5135 6932 1545], et al., of Changchun Institute of Biological Products, Ministry of Public Health; etc.]

[Text] The purified diphtheria toxin was found to be very stable. The ability of the Schick toxin prepared from it to neutralize diphtheria antitoxin was constant and coincided with the requirements of the British Pharmacopoeia (1980). Using the Schick solution the authors found that the corresponding rate between the Schick test and the rabbit intradermal neutralization test was 90-96.67 percent in healthy individuals, and no generalized urticarial reactions occurred. Because there was no "toxoid" in it, the sensitivity of the ST was increased. Its false positivity and combined reaction were significantly lower than those of the Schick toxin prepared from "aged" crude diphtheria toxin. Therefore, if the aim was only to define the sensitivity of the population to diphtheria or to compare the antigenic potency of different diphtheria toxoids, the control test could be omitted.

The results show that the sensitivity of the IHA test is lower than that of the Schick test and animal test. The corresponding rates between the IHA test and the animal test, and between the IHA test and ST, are 68.83 percent and 70.4 percent, respectively.

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EXPERIMENTAL OBSERVATION OF RHESUS MONKEYS CONTINUOUSLY TRANSMITTED HUMAN  
HEPATITIS A VIRUS

40091025 Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF  
EPIDEMIOLOGY] in Chinese Vol 8 No 5, Oct 87 pp 301-304

[English abstract of article by Guo Xingying [6753 2622 5391], et al., of the  
Department of Virology, Institute of Medical Microbiology, Zhejiang Academy  
of Medicine, Hangzhou]

[Text] An animal model of hepatitis A was performed using rhesus monkeys  
(*Macaca mulatta*). Three passages of human hepatitis A virus (HAV) using  
four infantile seronegative monkeys were proved by seroconversion and HAV  
fecal shedding. The primary material of HAV for transmission to monkeys was  
fecal suspension extracted from a hepatitis A patient during the latent phase.

In all of the animals, two SGPT peaks appeared within 20 weeks post inocula-  
tion. The first peak appeared during the 1st-7th weeks, and the second  
during the 12th-16th weeks. Sera conversion of the anti-HAV antibody was  
observed in all four monkeys within 10 weeks after inoculation. The hepatitis  
A virus antigen shedding in feces of first and second passage rhesus monkeys  
was detected by RIA and immune electron microscopy. It was proved to be  
present in stools of three of the animals.

In addition, three rhesus monkeys, man-fed for 2-8 months, had positive anti-  
HAV reactions. This means that rhesus monkeys can be infected naturally.

The authors conclude that rhesus monkeys may act an animal models of hepatitis  
A.

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**SIMPLE, RAPID METHOD FOR DETECTION OF SERUM HBsAg--LABELED AVIDIN-BIOTIN  
DOT ENZYME LINKED IMMUNOSORBENT ASSAY**

40091025 Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF  
EPIDEMIOLOGY] in Chinese Vol 8 No 5, Oct 87 pp 310-312

[English abstract of article by Hao Lianjie [6787 6647 2638], et al., of the  
Department of Infectious Disease, Tongji Hospital, Tongji Medical University,  
Wuhan]

[Text] Hepatitis B surface antigens (HBsAg) in 190 sera specimens were  
detected with labeled avidin-biotin dot enzyme linked immunosorbent assay  
(LAB-Dot ELISA). It was shown that the positive rate by LAB-Dot ELISA and  
by reverse passive hemagglutination (RPHA) was 82.6 percent and 65.7 percent,  
respectively. Using LAB-Dot ELISA, the lowest concentration for detecting  
HBsAg was up to 0.01  $\mu\text{g/ml}$ . It was 8 to 16 times more sensitive than RPHA.  
The specificity and reproducibility of this method were also confirmed. The  
LAB-Dot ELISA was simple and inexpensive. The entire assay could be  
completed within 3 hours. After dotting, the nitrocellulose sheet could  
be stored for more than 1 month. It was particularly applicable to the  
epidemiological investigations of hepatitis B.

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PRELIMINARY OBSERVATION OF CHANGES OF BLOOD RHEOLOGY IN EPIDEMIC HEMORRHAGIC FEVER

40091026 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 5 No 2, May 87 pp 83-87

[English abstract of article by Tang Baolu [0781 0202 4389], et al., of Rizhao People's Hospital, Shandong]

[Text] This paper reports the results of observation of the blood rheology and nail fold microcirculation found in 105 cases with epidemic hemorrhagic fever (EHF). It shows that there were increases of blood concentration in the early period, increases in blood viscosity and blood cell aggregation throughout the course, and an increase in blood coagulation during the late period. These results suggest that the abnormality of blood viscosity may be an important factor involving dysmicrocirculation in EHF. Observing blood rheology and nail fold microcirculation dynamically may provide an index for evaluating the severity and anticipating the prognosis of the disease, and for reference in treatment.

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ANTIBODY RESPONSE TO SPECIFIC POLYPEPTIDES OF EPIDEMIC HEMORRHAGIC FEVER VIRUS

40091026 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 5 No 2, May 87 pp 65-67

[English abstract of article by Hao Lianjie [6787 6647 2638], et al., of the Department of Infectious Diseases, Tongji Hospital, Tongji Medical University, Wuhan]

[Text] An IgG antibody against the specific polypeptides of epidemic hemorrhagic fever (EHF) virus was detected with the immunoblotting technique in 108 sera of patients with EHF (from 2 to 40 days after onset) and 13 sera from follow-up cases (from 83 days to 16 years). It was found that antibodies against the two polypeptides of about 68 and 66 Kd of the EHF virus were the main specific IgG antibodies produced by the hosts during EHF virus infection. These antibodies were detectably assayed at the third day of illness. At 17 to 19 days after onset, the titer of anti-p68 and anti-p66 antibodies reached its peak of 1:5583.40 and 1:2560.00 respectively (geometric mean titer), and then tended to decline. However, the titer of anti-p68 and anti-p66 antibodies in serum from one case after 16 years was 1:160 and 1:80, respectively. The above results show that the detection of anti-p68 and anti-p66 antibodies can be applied to the diagnosis and epidemiologic study of EHF.

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OBSERVATION OF RELATIONSHIP BETWEEN HBsAg IMMUNE COMPLEX AND HBeAg, HBV-DNA

40091026 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 5 No 2, May 87 pp 73-75

[English abstract of article by Jin Zhihong [6855 1807 1347], et al., of Henan Institute of Medical Sciences]

[Text] The HBsAg immune complex (HBsAg-IC) was detected in 46 patients with chronic active hepatitis (CAH), 143 with chronic persistent hepatitis (CPH), 35 asymptomatic HBsAg carriers and 41 healthy persons by PEG-Trypsin-RPHA. It was found that the positive rate of HBsAg-IC was 60.9 percent in CAH, 41.9 percent in CPH, 25.9 percent in HBsAg carriers and negative in healthy persons. The positive rate of HBsAg-IC bore a close association with abnormal SGPT, serum HBeAg-positivity and HBV-DNA. It suggests that there is a certain relationship between HBsAg-IC and the replication of HBV.

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REVERSE DOT MOLECULAR HYBRIDIZATION: NEW SIMPLIFIED ASSAY FOR SIMULTANEOUS DETECTION OF BOTH HBV-DNA AND HBV-DNA POLYMERASE

40091027 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 4 No 2, May 86 pp 97-100

[English abstract of article by Chen Yuanqing [7115 3220 0615], et al., of Shanghai Cancer Institute; etc.]

[Text] A new simplified assay for simultaneous detection of both HBV-associated DNA polymerase and HBV-DNA in serum--reverse dot molecular hybridization--has been established. The standard titration test has demonstrated that 1 pg of HBV-DNA (equivalent to  $3 \times 10^5$  Dane particles) in serum would give a positive signal. In a preliminary survey, 40 of 41 sera with HBsAg(+)/HBeAg(+)/HBV-DNA spot assay(+) gave positive results, while 3 of 14 HBsAg(+)/HBeAg(-)/HBV-DNA spot assay(-) cases were also positive. As a control, all 30 healthy blood donors with HBsAg(-)/HBeAg(-)/HBV-DNA spot assay(-) showed negative results. The technique could be valuable in large-scale clinical applications for identifying the infectious status of HBV carriers and for monitoring the blockage of the vertical transmission of HBV by vaccination as well.

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ISOLATION OF EPIDEMIC HEMORRHAGIC FEVER VIRUS FROM PERIPHERAL BLOOD MONONUCLEAR CELLS

40091027 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 4 No 2, May 86 pp 101-102, 73

[English abstract of article by Yang Weisong [2799 3634 2646], et al., of the Second Affiliated Hospital, Fourth Military Medical College]

[Text] Eight strains of epidemic hemorrhagic fever (EHF) virus were isolated from peripheral blood mononuclear cells (PBMC) in 12 patients with EHF. The isolation rate was 66.7 percent. The PBMC used for virus isolation were inoculated in a Vero cell culture medium. These virus strains were examined by the indirect immunofluorescence method using immune sera and antisera from patients in the convalescent stage. Of eight cases, the EHF virus was present in both the serum and PBMC in two cases, no virus was found in either the serum or PBMC in two, and the virus was isolated in PBMC in two of the remaining cases. It can be presumed that the virus antigen may combine with the antibody in the serum, but is not neutralized in PBMC.

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## RELATIONSHIP BETWEEN HBV ALBUMIN RECEPTOR ACTIVITY AND VIRAL REPLICATION

40091027 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 4 No 3, Aug 86 pp 125-129

[English abstract of article by Yao Guangbi [1202 0342 1732], et al., of the Clinical Immunology Research Unit, Jing'an Central District Hospital, Shanghai]

[Text] The quantitative relationship between HBV pre-s gene products (pHSA receptor) and HBeAg, DNA-p, viral particles and perinatal transmission of HBsAg from carrier mothers to their newborn babies has been studied. Among 59 chronic hepatitis B patients, high titers of the pHSA receptor ( $\geq 1:1,000$ ) were demonstrated in the sera of 25 out of 29 HBeAg positive cases, while only 8 of 30 HBeAg negative cases were pHSA receptor positive, with lower titers ( $\geq 1:100$  or less). The DNA-p activity and pHSA receptor titer were highly correlated in chronic hepatitis B--the DNA-p activity in pHSA receptor negative patients was  $22.8 \pm 98.6$  cpm, while in the high pHSA titer group ( $\geq 1:1,000$ ) it was  $210 \pm 246.0$  cpm ( $P < 0.01$ ). Among 43 HBsAg positive pregnant women, the pHSA receptor titers were  $1:1,000$  in 15 cases, with 13 of the babies becoming HBsAg positive within 12 months, while the pHSA receptor titers were  $\leq 1:100$  in 28 cases with only one of the babies becoming HBsAg positive within 12 months. The electron microscopic examinations found that the Dane particle had more pHSA receptor sites than did the 22-nm round HBsAg particle. These results show that qualitative determination of pre-s gene products (pHSA receptor) may be a useful marker for indicating the active replication of the virus.

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PIPEMIDIC ACID IN TREATMENT OF SHIGELLOSIS: DETERMINATION OF SENSITIVITY,  
BLOOD CONCENTRATION

40091027 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS  
DISEASES] in Chinese Vol 4 No 3, Aug 86 pp 145-148

[English abstract of article by Zhang Guangshu [1728 0342 2562], et al., of  
the 88th Hospital, PLA]

[Text] In vitro, both strains 205 and 128 of shigella isolated from patients' and carriers' stool were found to be very sensitive to pipemidic acid (PPA). The average MIC of the former was only  $1.7 \pm 0.77 \mu\text{g/ml}$  and that of the latter  $2.2 \pm 0.72 \mu\text{g/ml}$ , with the average MBC being  $4.0 \pm 0.98 \mu\text{g/ml}$  and  $3.6 \pm 0.73 \mu\text{g/ml}$ , respectively. When an adult took 1.0 gm of PPA, the blood level could reach  $6 \mu\text{g/ml}$  within one hour, and its effective level could be stably maintained if the medication interval was not longer than 4 to 6 hours. Long-acting PPA, PPA-CMC and PPA-Shellac can apparently decrease both its liberation and absorption rate in vivo. If 1.5 gm of the long-acting PPA was given orally every 6 hours, the blood level could surpass  $7 \mu\text{g/ml}$  after 2 hours. If the interval of medication was 12 hours, the blood level did not drop obviously, and the effective level of one-day medication could last 48 hours. If 4.0 mg of PPA/CMC was given orally, the average highest blood level reached  $20.4 \mu\text{g/ml}$  after 6 hours, and its effective concentration could last more than 24 hours. Therefore, it is concluded that PPA might be a better new synthesized drug for treating shigellosis, and the long-acting PPA offers the possibility of decreasing the times and lengthening the interval of medication.

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IN VITRO ANTI-BACTERIAL ACTIVITY OF 11 ANTIMICROBIAL AGENTS ON STRAINS OF  
S. TYPHIMURIUM

40091027 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS  
DISEASES] in Chinese Vol 4 No 4, Nov 86 pp 205-208

[English abstract of article by Wang Fu [3076 1788], et al., of the Institute  
of Antibiotics, Huashan Hospital, Shanghai Medical University]

[Text] The antibacterial activity of 11 antimicrobial agents on 61 strains of *Salmonella typhimurium* has been studied. The results of bacterial susceptibility testing showed that medillinam, cefamandole, fosfomycin and pipemidic acid were highly active against *S. typhimurium*, with inhibition rates being 98 to 100 percent, while those of the other seven antimicrobial agents, including ampicillin, piperacillin, furbenicillin, chloramphenicol, erythromycin, gentamicin and SMZ Co, were all below 40 percent. Of the 61 strains, 83.5 percent were resistant to more than 2 antibiotics, while 67 percent were resistant to more than 5 antibiotics. Strains isolated from normal carriers were far more sensitive than those from epidemic strains. Tests of antibacterial action showed that synergism might be obtained when mecillinam is combined with fosfomycin or cefamandole, with inhibition rates of 84.4 percent and 70.6 percent, respectively. The morphological change of *S. typhimurium* was also observed. Based on the findings mentioned above, a discussion of the antibiotics treatment is multiresistant strains of *S. typhimurium* is presented.

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MOLECULAR CLONING OF SPECIFIC FRAGMENTS OF ctDNA FROM MALE-STERILE LINE OF RAPE

40091028 Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 14  
No 5, Oct 87 pp 337-343

[English abstract of article by Gao Jie [7559 3381], et al., of the Institute of Genetics, Chinese Academy of Sciences, Beijing]

[Text] The ctDNAs of a male-sterile line from a rape variety with a radish cytoplasm and its fertile counterpart were isolated. Having been purified through Sepharose 4B gel chromatography, the ctDNAs were digested with EcoRI, BamHI, HindIII, PstI and XhoI, and the restriction patterns were obtained. Of all the patterns, there were distinct differences between the male-sterile line and its counterpart except for the PstI pattern. The DNA of three specific fragments from the BamHI pattern of the male-sterile line was recovered. After being incubated with plasmid pBR322 digested by BamHI as well as T4-DNA ligase, respectively, three recombinants were obtained. Then the recombinants were used to transform E. coli HB101. Through resistant screening, clone hybridization and electrophoresis analysis, three clones carrying the specific fragments were obtained. The characteristics of these fragments are currently being investigated. (Paper received 20 Nov 86.)

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## CLONING OF 17kb PROBE FOR SHIGELLA SPECIES, ENTEROINVASIVE E. COLI

40091029 Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 278-280

[English abstract of article by Su Guofu [5685 0948 1381], et al., of the Institute of Basic Medical Sciences, Academy of Military Medical Sciences, Beijing; Wei Yanling [7614 3601 3781] of Hospital No 302, PLA, Beijing]

[Text] A 14024dal large plasmid isolated from *S. flexneri* 5 was purified in a cesium chloride gradient and digested with restriction nuclease EcoRI. After electrophoresis, the 17kb EcoRI fragment related to invasion was recovered from agarose gel, recombined with calf intestinal alkaline phosphatase treated pBR325, and then transformed into *E. coli* C600. The recombinant containing the 17kb EcoRI fragment was called pSF001. From the recombinant plasmid, the 17kb EcoRI fragment was prepared. After  $P^{32}$  labeling, the DNA fragment was used as a probe to detect *Shigella* species and enteroinvasive *E. coli*. The results showed that the 17kb probe was highly specific and sensitive. It will be useful not only for the selection of recombinants in the laboratory, but also for large-scale epidemiological studies.

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STUDY OF PLASMID CODING FOR ENTEROTOXIN. V. COMPARISON OF PLASMIDS FROM CFA<sup>+</sup>, CFA-ETEC STRAINS

40091029 Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 281-285

[English abstract of article by Yao Ruijin [1202 3843 6855], et al., of the Department of Microbiology, Fujian Medical College, Fuzhou]

[Text] The plasmids of 22 (13 possessing CFA/I and 9 possessing CFA/II) enterotoxigenic *Escherichia coli* strains were investigated. CFA/I<sup>-</sup> and CFA/II<sup>-</sup> derivatives were isolated from all 22 CFA/I<sup>+</sup> and CFA/II<sup>+</sup> strains, among which 12 (55 percent) strains, after one passage, became negative for CFA/I or CFA/II at a frequency of 40-52 percent, a figure that is higher than that currently reported. The type of drug resistance and the ability to produce colicine of these derivatives were similar to those of the wild-type *E. coli* strains. There was a close relationship between CFA/I or CFA/II and ST. Of 16 CFA/I<sup>-</sup> and CFA/II<sup>-</sup> derivatives, 10 (63 percent) were found to lose ST as well ( $P < 0.01$ ) and, among these, 3 strains had also lost a large plasmid, while 1 strain had also lost 2 small plasmids. Another strain (E-041-P) lost one large plasmid ( $71 \times 10^6$ ) together with CFA/II, LT and ST, suggesting that the plasmid code for CFA/II, LT and ST production. Of five LT<sup>+</sup>/ST<sup>-</sup> strains, only one strain lost CFA/I, LT and a 65Md plasmid, which suggested that genes encoding CFA/I and LT may be located in a single plasmid, something that had not been previously reported.

No CFA/I plasmid could transfer from 7 CFA/I<sup>+</sup> strains, but 19 of 22 (86 percent) CFA<sup>+</sup> ETEC strains also contained R plasmids, which may mobilize the CFA/I plasmid into *E. coli* K802. The transconjugates obtained from crosses with ETEC E-100 (CFA/I<sup>+</sup>, LT<sup>+</sup>/ST<sup>+</sup>, Cm Tc SD) produced only LT, not CFA/ or ST, and their properties are also described.

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GENETIC TRANSFORMATION IN LOCAL STRAINS OF MORAXELLA OSLOENSIS

40091029 Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 293-295

[English abstract of article by Zhong Wenpeng [6988 2429 5570], et al., of the Moraxella and Allied Bacteria Reference Laboratory of CMCC(B), Jiangxi Institute of Medical Sciences, Nanchang]

[Text] The relationship between local strains and the type strain *Moraxella osloensis* was investigated with streptomycin resistance transformation assay, both quantitatively and semiquantitatively. Altogether, 10 strains were included in this study.

In quantitative assay, three of four local strains were classified as *M. osloensis* by conventional tests and exhibited high ratios of inter- to intra-strain transformation, ranging from 0.32 to 1.34, suggesting a close homology with the type strain of *M. osloensis* ATCC 19976, but the other one only gave the low ratio of 0.008. Both the local moraxella-like strain 43018 and *Acinetobacter calcoaceticus* strain 44001 showed a very low ratio of 0.003. The three others exhibited no affinity, except for the reference strain of *M. osloensis* (strain 43008), which showed a weak positive reaction in semi-quantitative assay.

The results also showed that the competence of streptomycin susceptible cells of local strains 43015 and 43016 was not as efficient as that of the type strain. The local strain 43017 had no competence at all.

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SEROTYPING OF PLESIOMONAS SHIGELLOIDES

40091029 Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 309-312

[English abstract of article by Yang Zhengshi [2799 2973 2514], et al., of the National Institute for the Control of Pharmaceutical and Biological Products, Beijing; Zhu Huancheng [2612 3562 2052], et al., of Maanshan Hygiene and Anti-epidemic Station; Yu Wenbing [0151 2429 3521], et al., of Hangzhou Hygiene and Anti-epidemic Station]

[Text] A total of 210 strains of *Plesiomonas shigelloides* collected from different sources in China were identified by diagnostic sera 01-50. The serotypable frequency of strains from healthy subjects and diarrheic patients was 56 percent and 60.3 percent, respectively, and from animals was 83.7 percent. Of the serotyped strains, 132 were distributed in 37 different O antigens, with about 60 percent of the serotyped strains being concentrated in 10 O antigens, i.e., 019, 024, 039, 044, 015, 017, 027, 01, 038 and 042. Most of the O antigen strains isolated from diarrheic patients were also present in normal stool. Of the strains with O antigens, 50 percent were shared by humans and animals, while only 3 percent were unique to animals. According to the analysis of serotypic distribution, diarrhea caused by *Plesiomonas shigelloides* is closely related to healthy human and animal carriers.

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**RAPID IDENTIFICATION OF DENGUE VIRUS ISOLATES BY IMMUNO-ENZYME STAINING WITH MONOCLONAL ANTIBODY**

40091029 Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 313-316

[English abstract of article by Huang Rutong [7806 1172 4827], et al., of the Institute of Microbiology and Epidemiology, Academy of Military Medical Science]

[Text] A method for rapid identification of dengue virus isolates is introduced. A total of 68 clinical specimens from dengue fever patients in Guangzhou and Hainan Island, from 1985 to 1986, were inoculated onto a C6/36 microculture with a piece of glass, and were harvested when 25 percent of the cells showed CPE. Forty-four dengue virus isolates were identified rapidly by immuno-enzyme staining with the four type-specific McAbs and polyclonal DEN-2 hyperimmune mouse ascitic fluid. The results revealed that the agents of dengue fever in Guangzhou in 1985 were of the dengue virus type 1, and the agents on Hainan Island in 1985-1986 were of the dengue virus type 2. The authors' method demonstrates that the IE method is rapid, simple, specific and sensitive for serotyping the first passage isolates.

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STUDY OF HUMAN INTERFERON- $\alpha$  ANTIBODY AFFINITY CHROMATOGRAPHY

40091029 Beijing ZHONCHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 7 No 5, Oct 87 pp 332-335

[English abstract of article by Deng Jiong [6772 3518], et al., of the Department of Microbiology, PLA No 2 Military Medical University, Shanghai]

[Text] In this report, the authors present studies of the preparation and application of an anti-interferon antibody column. The antiserum against human lymphoblastoid interferon (HuLy-IFN) was prepared by immunizing sheep with partially purified Namalwa IFN. The IgG fraction of the antiserum was adsorbed repeatedly on the "impurity" column and trypsin inhibitor column. An anti-IFN antibody column was established by coupling the adsorbed anti-IFN antibody to Sepharose 4B. With this antibody affinity chromatography, crude Namalwa IFN was purified in one step to specific activity of  $8 \times 10^6$  to  $4 \times 10^7$  u/mg protein. The peak of purified IFN activity in elution was concentrated in 1-3 fractions (3-8 ml). Similar results were obtained in purifying human leukocyte IFN (HuLeIFN) by this column. The results also showed that the polyclonal antibody column purified recombinant leukocyte IFN- $\alpha$ D (LrIFN- $\alpha$ D) to homogeneity as analyzed on SDS-polyacrylamide gel electrophoresis.

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## NEW TOTAL SYNTHESIS OF CHUANGXINMYCIN, STUDY OF ITS STEREOISOMERS

40091031 Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese Vol 22  
No 9, Sep 87 pp 671-678

[English abstract of article by Guo Xialing [6753 7209 0407] and Zhang Zhiping [1728 5268 1627] of the Institute of Medicinal Biotechnology, Chinese Academy of Medical Sciences, Beijing]

[Text] A new total synthesis of the unique indole containing an antibiotic, chuangxinmycin, is described. This compound was assembled from indole using a scheme that combined the silylation with the trimethylsilyl group displacement directly to produce a 4-sulfur-substituted indole. Further transformations involving acetylation at the indole 3-position, with a spontaneous intramolecular condensation to 1-acetyl-3,4-dehydrochuang-xinmycin ethyl ester and a cis hydrogen addition reaction with concurrent hydrolysis of the ester group, furnished racemic chuangxinmycin.

Racemic chuangxinmycin (3S, 4R and 3R, 4S enantiomers), when treated with S(-)- $\alpha$ -phenylethyl amine in methanol, (S)- $\alpha$ -phenylethyl amine-(3S, 4R)-chuangxinmycin salt, was separated into bar crystals upon cooling. (S)- $\alpha$ -phenylethyl amine-(3R, 4S)-chuangxinmycin salt was isolated as prisms from the mother solution. Both of them were treated with acid to produce (-)-chuangxinmycin and (+)-chuangxinmycin, respectively.

Treatment of both (-)-chuangxinmycin and (+)-chuangxinmycin with KOH in dioxane or DMF containing water, followed by separating and purifying, resulted in (+)-epichuangxinmycin and (-)-epichuangxinmycin, whose configurations have been confirmed to be 3S, 4S and 3R, 4R by spectral data.

Among these four stereoisomers, only that having the natural configuration is active against bacteria. Conversion of the other three into chuangxinmycin was effective by the following route: The stereoisomeric esters were dehydrogenated by DDQ to give the 3,4-dehydro product in high yields, which were in turn hydrogenated and resolved, thereby completing the first cycle.

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## STUDY OF R PLASMIDS FROM SALMONELLA TYPHIMURIUM

40091030 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 5 No 1, Feb 87 pp 2-5

[English abstract of article by Wang Jingli [3769 7234 5461], et al., of the Institute of Antibiotics, Shanghai Medical University]

[Text] From October to November 1982, 45 epidemic strains of *Salmonella typhimurium* were collected from several outbreaks in Shanghai. Of them, 73.3 percent were resistant to ampicillin, chloramphenicol, tetracycline, gentamycin, kanamycin, streptomycin, piperacillin and SMZ Co, and 93.2 percent were resistant to at least five antimicrobial agents. However, only one of nine strains isolated from *S. typhimurium* carriers was multiresistant. By conjugation and transformation, the multiresistance was shown to be plasmid-mediated. Of the R plasmids, 25 percent were transferable to *E. coli* K12<sup>Rif</sup>, with a frequency of  $10^{-4}$  to  $10^{-6}$ . Electrophoresis in the agarose gel of plasmid preparations showed that the plasmid pattern of epidemic strains was similar, with each of them having five to six plasmid bands, while the larger plasmids were the genes responsible for multiresistance. In contrast, there was only one plasmid band in the non-epidemic strain.

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CHANGES IN DRUG SENSITIVITY OF SHIGELLA IN HANGZHOU

40091030 Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 5 No 1, Feb 87 pp 34-37

[English abstract of article by Yu Wenbing [0151 2429 3521], et al., of the Sanitary and Anti-epidemic Station, Hangzhou]

[Text] In this paper, it is reported that 1,241 strains of *Shigella* obtained from 1975 to 1985 in Hangzhou were found resistant to 11 types of antimicrobials in susceptibility tests. The rates of drug-resistance of Co-TMP, sulfonamides, chloramphenicol, gentamycin, neomycin, streptomycin, erythromycin, furazolidone, nitrofurantoin and tetracycline showed the tendency to increase. There was a significant difference in the rates of drug-resistance between the epidemic strains of the city proper and those isolated from suburban districts. The number of multi-resistant strains was markedly higher than that of mono- or bi-resistant strains of *Shigella sonnei* and *S. flexneri*. The cause of the change in drug sensitivity has been preliminarily analyzed and the mechanism of drug-resistance is discussed.

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STUDY OF HIGH  $T_c$  SUPERCONDUCTOR  $YBaCu$  OXIDE

40090042 Nanjing NANJING DAXUE XUEBAO [JOURNAL OF NANJING UNIVERSITY]  
in Chinese Vol 23 No 3, Sep 87 pp 403-406

[English abstract of article by Ding Shiyong [0002 0013 5391], et al., of the Department of Physics, Nanjing University; Zhang Wenbin [1728 2429 1755] of the Modern Material Analysis Center, Nanjing University]

[Text] The authors report the preparation and study of a high- $T_c$  superconductor  $YBaCu$  oxide. The  $YBa_2Cu_3O_x$  samples were prepared by a high temperature sintering process.  $T_c$  is 91 K according to standard resistance tests. Regions of diamagnetization occupy 85 percent of the sample volume by magnetization measurement. The Josephson effect was observed in the Josephson junction made of the superconductors in liquid nitrogen. All of this confirms the authors' claim to having obtained high- $T_c$   $YBa_2Cu_3O_x$  superconducting samples.

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OBSERVATIONS OF MICROSTRUCTURE OF YBaCuO SUPERCONDUCTOR

40090042 Nanjing NANJING DAXUE XUEBAO [JOURNAL OF NANJING UNIVERSITY]  
in Chinese Vol 23 No 3, Sep 87 pp 407-412

[English abstract of article by Yu Zheng [0151 2973], et al., of the Department of Physics, Nanjing University; Hu Meisheng [5170 2734 3932], et al., of the Modern Material Analysis Center, Nanjing University]

[Text] The authors report observations of the microstructure of the high-Tc superconducting material YBaCuO. The composition of the sample is  $\text{YBa}_2\text{C}_3\text{O}_x$ , determined by EDAX, and the x is an unknown parameter at present. The micrograph of the material consists of a large number of grain-like substances under Scanning Electron Microscopy. The grain size is around  $10\mu$ . X-ray diffraction patterns show the samples are nearly single distorted perovskite. TEM observations confirm that the grain-like substances are indeed crystal grains with various crystal defects, such as twins, dislocations, stacking faults, etc.

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